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A

POPULAR INTRODUCTION

TO

SANITARY SCIENCE.

PART II.

WAR IN ITS SANITARY ASPECTS.

BY

WILLIAM A. GUY,

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&c. &c. &c.

HENRY RENSHAW,
356 STRAND, LONDON.

1874.

PUBLIC HEALTH.

PART I.

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PREFACE TO PART II.

THESE four Lectures on War in its Sanitary Aspects are an expansion of the three which I delivered at the College of Physicians in the year 1871, and they were themselves but a continuation of the eight Lectures given at King's College the previous year. In order of time, as in mode of treatment, the second course of Lectures was a fitting sequel to the first, and accordingly I have numbered and paged them so that when bound together the two series shall together present a "History of the Prevalent and Fatal Diseases of the English Population from the earliest times" to the end of the War with France which terminated in 1815. To give completeness to the joint work, I have prepared a copious index of the contents of the twelve lectures, and have added what I think will prove acceptable to many Students of Sanitary Science, a list of the books that I have quoted or used.

And here I have to acknowledge in a very special manner my obligations to the admirable papers of Mr. Hodge, a former President of the Institute of Actuaries, on the Mortality of the Army and Navy, and to thank Dr. Graham Balfour for several useful hints and suggestions.

The four Lectures now published will be found to contain more than one Sanitary episode written after the

model of those contained in the earlier course. To the accounts then given of the Devonshire Colic, the Small-pox at Blandford, and the outbreak of Mania among overcrowded pauper children; of the Plague in London and at Eyam; of the Fire of London and its effects, the projects of Wren and Evelyn for rebuilding the city, and the attempt to ventilate the House of Commons; of Anson's Voyage, and Captain Cook's Services; and of the Grand Sanitary Reforms of Howard and Jenner; I have added a similar account of Lord Howe's victory of the 1st of June, of the Campaigns of the Peninsula and Egypt, and the expedition to Walcheren; of Dr. Brocklesby's extempore Hospitals; and of Ambroise Paré's singular reform in the treatment of Gunshot Wounds.

Of these recent episodes I may venture to repeat what I had already said of those contained in my earlier lectures, that they have been carefully compiled and condensed from the original documents, and that they will be found not the less adapted to popular teaching, that they are as accurate in their statements as I was able to make them.

To those who aim at imparting popular instruction in Schools, whether for children or adults, to soldiers and sailors, or to working men in town or country, I trust that I may, with some confidence, recommend these Episodes of the grand Sanitary History of England.

26, Gordon Street,
December, 1873.

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THE WAR OF THE FRENCH REVOLUTION.

THE terrible conflict which, but a short time since, was raging on the territory of our nearest continental neighbour, destroying one empire and building up another, and ending in the complete failure and collapse of a great military nation, has revived that interest in war and all that relates to it, which had been gradually dying out since 1815, in spite of the many warlike episodes, some anxious and even critical, in which England has borne a part in that period of fifty-eight years. The revived interest of which I speak centres in two points—armaments and men. With the first the physician has nothing to do, with the second much; for the excessive sickness and mortality that formerly attended every warlike operation by sea, and which still follow in the track of armies, have for him not only a direct interest but an indirect one, inasmuch as he recognises in them in an exaggerated form the operation of the same causes that so fatally afflict the civil population.

In the course of eight lectures given at King's College in the spring of 1870, and since published, I brought the Sanitary History of England down to the end of the eighteenth century; and I expressed a hope that I might be able, on some future occasion, to extend it into the nineteenth. The war between France and Germany, by reminding me of our long struggle with revolutionary and imperial France, has led me to select for separate treatment

the first fifteen years of the nineteenth century, taken in connexion with the last seven years of the eighteenth; and I feel that if I can treat these twenty-two years of almost uninterrupted warfare, as I have already treated our earlier sanitary history, I may render some further service to that science of Hygiene to which I have so long been attached.

I am about, then, to do for war in its Sanitary aspects what I have already done for the Health-history of England, without special reference to the warlike conflicts, the civil strifes and foreign struggles which make up so considerable a part of our annals, and had so much to do with the introduction and spread of many a fatal pestilence.

The subject of war, in its relation to disease, forces itself on the notice of the English sanitary historian of the nineteenth century, as the first to be considered; for war was the special business of England during by far the greater part of the first fifteen years of the century, as it was of the last seven of the century preceding—as it had been, to say the truth, of nearly the whole eighteenth century, from one end of it to the other.

I might, therefore, have taken up this topic of war in its Sanitary aspects at some earlier period of our history —say, in relation to the year 1713, when the treaty of Utrecht brought to a close the War of Succession, rendered famous by the victories of Marlborough; or to those later wars that came to an end in 1748, 1763, or 1782.

But if any one war may claim to be chosen rather than another, as germane to a treatise on war in general, assuredly it is this of the great French Revolution; for it lasted, with only short intermissions, no less than two-and-twenty years, testing and straining to the utmost the resources of England in men and money—in skill, cou-

rage, and endurance—crowned with many a glorious victory by land and sea, chequered with not many reverses, and but very few disasters. In this long period of nearly a quarter of a century, war presented itself in every possible aspect—many-sided—a thing of infinite variety. There were military and naval operations, and co-operations too, of every possible and conceivable kind. By land—stormings as of Badajos, and sieges as of St. Sebastian; obstinate, stolid soldiers' battles like that of Albuera; strategic trials of skill such as that which ended with the victory of Salamanca; great pitched battles, as at Waterloo; victorious onward movements, like that which led our troops to Paris; masterly retreats, as to the lines of Torres Vedras, or that earlier one to Corunna, crowned by victory, and hallowed by a hero's death, or that still earlier one to Ostend in the winter of 1795 when Wellington (then Lieutenant-Colonel Wellesley) did good service in the rear-guard; glorious campaigns, as of Egypt and the Peninsula; disastrous, destructive failures, as at Walcheren and New Orleans: but, on the whole, a grand balance of victories and successes, of which neither the France of Napoleon the Great nor the Germany of 1870 would need to be ashamed.

At sea, our own special element (though they speak foolishly who deny to the possessor of India, the country of a Marlborough and a Wellington, the name of a great military power)—at sea, there were rich West India Islands taken and retaken; treasure-ships captured, or destroyed; fleets—French, Dutch, Danish, and Russian—brought home in triumph; enemies' war-vessels beaten off by merchant-ships; skilful escapes from superior forces; adventurous boat attacks; strong fortresses, such as Malta, and valuable naval stations such as the Cape of Good Hope, added to our dominion; great sea-fights, critical and decisive, culminating in Trafalgar; and the

prestige we had lost in some single combats with America, fully restored by the chivalrous duel of the *Shannon* and *Chesapeake.*

From the very nature of the case every military enterprise, in which an insular people engage, must combine naval and military operations. It is not easy, therefore, to select, as deserving special notice, any one instance of successful co-operation. But the mind dwells with peculiar interest on Sir Sydney Smith's masterly defence of Acre; the first and not the least among the failures and disappointments of the first Napoleon.*

It is from among the warlike events of this great conflict of nearly a quarter of a century that I have set myself to extract what knowledge I can of war as a destroyer of human life; a subject which has assuredly lost none of its attractions through recent events. Nor, if we pass in review the half century and more that has elapsed since Waterloo, shall we find any reason for giving to war and all that belongs to it less attention than we had previously bestowed upon it. For that man must be strangely unreasonable and unteachable who cannot see that war is at least as natural as any of the pleasant vices which the nations practise and condemn; and that a sincere love of peace ought to be looked upon in the same light as cleanliness, industry, foresight, moderation, temperance, and health—the gradual growth of a state of things the reverse of natural, to which we are wont to give the names of progress and civilization. And if there is any one in England, or out of it, who thinks that the nations have already travelled so far on this artificial road that war is left behind them as a thing of the past,

* I allude to this passage of arms with special interest, as I had the pleasure of hearing from the lips of the gallant and adventurous sailor himself many details of the siege and defence of Acre, with which he was wont to entertain his visitors at Paris.

and that peace stretches before them like some rich fruitful plain, I ask him to look for a moment only at the events of the last half century, and at those which, so short a time ago, were passing almost under our own eyes.

In June, 1815, our twenty-two years' contest with France closed with the battles that culminated at Waterloo, in which some 50,000 of our troops (British or in English pay) had one-fifth of their number killed and wounded. That was the fact of the day known of all men, and brought home to many a bereaved and grieving household. But statists and statesmen, and the people at large in a dim sort of way, taking note of the struggle from one end of it to the other, knew that, on an average of all the years of war, more than 300,000 picked men, in the prime of life, had been continuously withdrawn from the productive labours of peace to serve in our fleets and armies; that at least 175,000 such men (say 8000 for every year of warfare) perished in excess of those who would have died had peace prevailed; that prisoners, increasing in number year by year till they reached a total of 10,000 or so, had languished, many dying, in unwholesome French dungeons, every effort to effect an exchange of prisoners having proved abortive; while other 10,000 free Englishmen were lawlessly detained on the resumption of the war after the peace of Amiens (perhaps as a partial counterpoise to the 70,000 Frenchmen and their allies at one time in our hands); and lastly, that, in addition to twenty-two years of war budgets, our national debt had been increased by 630 millions, or more than thirty millions for each of the twenty and a half years of actual warfare. Add to all this, the sudden paralysis of all the industries created and fostered by the war, and the necessary distress thence arising, and we have a state of things pleading most eloquently for peace.

And yet, the very next year, we bombard Algiers; only eleven years later we take part in the battle of Navarino; and after the lapse of seven years more, we are found interfering by force of arms, in a somewhat irregular way, in the domestic affairs of Portugal and Spain. In 1840 we bombard Acre, check the ambition of Mehemet Ali, and narrowly escape war with France. The year 1854 sees us fighting against Russia in the Crimea, and (not to weary you further with dates) we contrive to have diplomatic or colonial knots to cut with the sword, in Belgium, in Canada, at the Cape, in New Zealand, Affghanistan, and the Punjaub; in Burmah, Scinde, China, Japan, and Abyssinia. And yet, all this time, we loudly professed, and sincerely felt, a love of peace. So eagerly, indeed, did we desire it, that we contrived to see in the Great Exhibition of 1851 a sure pledge of it. The whole nation was possessed by one benevolent enthusiasm; and it was not till the Crimean War broke out, three years afterwards, that we were disenchanted.

Now that we are able to look back to that fond delusion, and the war with Russia that so soon, and so rudely, dispelled it, we are forced to confess that that divine *vox populi* (voice not of the ignorant masses, but of the cultivated leaders of opinion) was only to be compared to the strange fancy of the poor maniac gentleman who thought himself the Crystal Palace, and was consistently angry with the Government for threatening to remove it.

But I am aware that in what I have just said, I have omitted some considerations that could not fail to be taken into account by the men who were living in 1815. They knew, for instance, that in the ten years that had elapsed between 1801 and 1811, the population of England and Wales, in spite of its losses by the war, had

grown from little more than nine millions to little less than ten millions and a half, the increase exceeding a million and a quarter of people, or, one year with another, about 128,000 a year; and that against the soldiers and sailors continuously withdrawn from peaceful labours, those whom the war destroyed, those others who languished in captivity, the war budgets, and the debt, there were certain obvious gains to be set off. Malta in the Mediterranean, and Heligoland in the North Sea, Ceylon and the Mauritius, British Guiana, and four West India Islands, were added to our possessions, and our Indian Empire was freed from French intrigue and interference. And these gains to us, be it recollected, represented losses to rivals more or less formidable.

To these our material gains we must add some of a wholly different order, hard to estimate, perhaps inestimable—many brilliant pages added to a history already glorious, the precedent of a most manly and persevering struggle crowned with signal success, a heritage of noble names and grand examples—tenacious patriotic Pitt, wise Marquis Wellesley, gentle and magnanimous Lord Howe, stern and resolute St. Vincent, ingenious and enterprising Dundonald, chivalrous Nelson, gallant and generous Sir Sydney Smith, incomparable Wellington, greatest among the great, if measured by the resources placed at his command, his administrative talent, his success in every form of warlike enterprise, the number of great strategists and generals whom he foiled and defeated (Junot, Victor, Massena, Ney, Marmont, Jourdain, Soult), without an equal, the superior no less than the conqueror of Napoleon, the apostle of humanity in war! our Howard of the battle-field!

It is, of course, impossible even to guess at the value of the acquisitions, of which the foregoing are but the more conspicuous illustrations, in comparison with the

sacrifices, past, present, and future, by which they have been purchased; but assess them at their highest conceivable value, and we must still feel that there remained to the men of 1815, and to all that have come after them, a balance of most weighty reasons against war and in favour of peace.

If now we turn from these events half a century and more old, to those that have so lately been occurring under our own eyes, we must confess, however reluctantly and sadly, that war is still to be classed among the things most natural to man. For not only were two great nations, to neither of which can we deny the name of civilization as men commonly construe the word, fiercely contending, the one for the European supremacy it had so long claimed, the other for security against aggressive interference; but we ourselves, with the horrors of war fully realized, as we have never realized them before, proclaimed that we too were ready to fight if our interests or our honour were assailed. Nay, there was a section of our people that, partly touched with pity for France because she was unsuccessful and suffering, partly oblivious of the claims to sympathy of the kindred nation which shared with us the toils and risks of the short campaign of 1815, while thinking only of our Crimean comrade of 1854, and partly, perhaps, excited by the idea of a republic, so strangely fascinating to minds more remarkable for generosity than for sense, would have plunged England, without hesitation or remorse, into this sea of blood.

Seeing then that war, with all its bloody horrors, still retains its strange fascination; that under one pretence or another, it remains one of man's most natural occupations; that even in these later times, monarchical England, France, and Italy, in the Crimea, against despotic Russia; republican America in the contest between North and

South; Imperial Germany and France quite recently; Versailles and the Commune of Paris, have all in turn fought for their several ideas, and to prevent aggression or dismemberment, or even remote contingent mischiefs, I feel that I am fully justified in assuming that war, in any or all of its more important aspects, is a subject which ought to occupy much of our attention, and is likely to repay any labour we may see fit to bestow upon it.

I have said that this great war with revolutionary and imperial France, embraced between its beginning and final close two-and-twenty years, occupying no less than twenty years and a half of the interval; and it may be well that I should refresh your memories and mine by the shortest outline I am able to draw of its events by land and sea, in the order of their occurrence.

Our warlike operations commenced in 1793, with the occupation, defence, and loss of Toulon. A garrison composed of most heterogeneous materials—English, French royalists, and Spaniards—succumbed to a well-appointed French Army, and the genius of the first Napoleon; Sir Sydney Smith doing excellent service in destroying and capturing French ships, and rescuing thousands of French royalists from the vengeance of the republic.

In 1794 St. Domingo and the French West India Islands, Corsica (with the strong fortresses of Bastia and Calvi), felt the force of English military and naval co-operation, and the navy, under Lord Howe, on the 1st of June, won its first great victory. On land, with Austria for ally, we began and ended our first campaign in Holland, gaining a victory at Cambray, and conducting ourselves most creditably under the command of the Duke of York, but forced at length to a retreat and evacuation of the country, in which retreat Lieutenant-

Colonel Wellesley did good service in the rear-guard. This year, be it observed, was noted for the severe frost which enabled a squadron of French cavalry to capture the Dutch fleet of fifty vessels.

1795 witnessed the services of our fleet under Lords Hotham and Bridport; the masterly manœuvres of Cornwallis, by which he eluded the enemy's fleet of twenty-nine sail, and, on a different element, rivalled the glory of the retreat of the 10,000 under Zenophon; the capture of the Cape of Good Hope; and the short and unsuccessful descent on Quiberon—the second of our failures in the Low Countries.

1796, the year of Napoleon's first Italian campaign, is remarkable chiefly for Abercrombie's successes in the West Indies.

1797, the year of the French failure in Wales, is memorable for our mutinies at Spithead and the Nore, and the great naval victories of St. Vincent and Camperdown.

In 1798 we suffered the Irish Rebellion, and won the great victory of the Nile.

In 1799 Colonel Wellesley commenced his brilliant career of military and administrative success in India, at the siege of Seringapatam; Nelson succoured Naples; Sir Sydney Smith baffled Napoleon at Acre; the Dutch fleet surrendered to Admiral Mitchell; and we made our third, not inglorious though unsuccessful, campaign in Holland.

The chief incidents of 1800 were the reduction of Malta, and Colonel Wellesley's defeat of Dhoondiah and capture of the Hill Forts.

1801 is memorable for Abercrombie's victory and death, and the expulsion of the French from Egypt; the battle of Copenhagen, under Parker and Nelson; the gallant action of Sir James Saumarez, off Cadiz; and the capture of Swedish and Danish West India Islands.

In 1802 (the year of the Treaty of Amiens), Boulogne was bombarded by Nelson.

1803 (the year of the renewal of the war), Major-General Wellesley won the great battle of Assaye, and broke the Mahratta power.

In 1804 we were again teased with an Irish Rebellion, and took some treasure-ships from Spain.

1805 was the year of Nelson's victory and death at Trafalgar, and of Sir Robert Calder's action off Cape Finisterre.

In 1806 Sir John Stuart fought and won the gallant battle of Maida; St. Domingo, Capri, the Cape, and Buenos Ayres were taken; and Sir Arthur Wellesley came back from India, ready to take part in the attack on Copenhagen in

1807, when also Duckworth forced the passage of the Dardanelles.

1808 is famous as the year in which Sir Arthur Wellesley landed in Portugal, won the battles of Roleia and Vimiera, and was stopped in his opening career of conquest by the Convention of Cintra.

In 1809 Sir Arthur resumes the command in Portugal, crosses the Douro, and wins the battle of Talavera, thus supplying a counterpoise to the loss of Sir John Moore at the victory of Corunna; while the disastrous campaign of Walcheren may be said to have found its counterpoise in Cochrane's gallant attack in the Basque Roads, Collingwood's success in the Bay of Rosas, and the capture of Bourbon and the Mauritius, of the Ionian Islands, Martinique, Cayenne, and St. Domingo.

In 1810 Wellington won the battle of Busaco, stopped and foiled Massena at the lines of Torres Vedras, leaving him no alternative but a disastrous retreat.

In 1811 the capture of Java was almost forgotten in presence of the gallant victories of Barrosa, Fuentes

d'Onoro, and Albuera, and the good service rendered by Sir Thomas Graham at Cadiz.

1812 was the year of the grand strategic victory of Salamanca, followed by the entry into Madrid, the sieges of Rodrigo and Badajos, and the less successful attempt at Burgos.

1813, the year of the action of the *Shannon* and *Chesapeake*, was the year also of the victory of Victoria and the storming of St. Sebastian, and of that series of gallant and successful encounters with Soult, the passage of the Bidassoa, and entry on the "*sacred territory*" of France, so quickly followed by the passage of the Nivelle and Nive.

Early in 1814 Wellington forced the passage of the Adour, delivered Bayonne and Bordeaux, won the battle of Orthez, and the lesser conflicts which led up to the great victory of Toulouse, by which France, and Paris itself, was laid open to our victorious arms.

1814, which witnessed this great recompense of a long struggle, witnessed also another and last attempt, under Sir Thomas Graham, to operate in Holland; and in America, the short campaign which had for its chief result the capture of Washington.

1815 opened with the disastrous repulse from New Orleans, and the slaughter of the veteran troops whom we missed so much at the crowning struggle of Waterloo.

In this brief survey of the events of the great war with France, I have made no mention of many a gallant naval fight between small squadrons or single ships, or of many a brave passage of arms between English and foreign soldiers, led by commanders whose fame has been overshadowed by the greater deeds of a Wellington or a Buonaparte. Some idea, however, may be formed of the activity of our warlike operations, from the fact that Mr. Hodge was able to register the results of no

less than 576 naval actions, which took place in the interval between 1793 and 1815, being at the rate of more than two a month for the whole period of twenty-two years. Some of these were cases of co-operation between our army and navy. Our military operations do not present such considerable figures, inasmuch as they were the continuous incidents of campaigns, of which some eighteen great battles and thirteen sieges were the prominent occurrences.

Out of the events of these twenty-two years of active warfare, I shall select, as affording special instruction in Sanitary Science, one great naval action, with the events that preceded and followed it (I mean Lord Howe's action of the 1st of June); the memorable campaigns of the Peninsula and of Egypt; and the disastrous expedition to Walcheren.

But that I may give to the subject of war in its sanitary aspects as much unity of character and logical consistency as it admits of, I must first inquire under what subordinate headings or divisions the subject may best be treated.

In the first place, it is very natural that we should bring to bear on war such light as our experience of mankind living in a state of peace can furnish. Then, I think we should proceed to seek out certain standards of comparison to which to refer the deaths by disease that war itself occasions, and those standards we shall find in our lists of killed and wounded. And as the French Revolutionary War, which I shall take throughout as my point of departure, involved both naval and military operations, and these have their peculiar features, the two should be treated separately, and then compared the one with the other.

Furnished with these standards of comparison, afforded by the killed and wounded, I shall proceed to use

them as measures of the losses inflicted by disease, distinguishing the Naval from the Military Service, and, as far as may be needful, one kind of warlike operation, by sea or land, from another. *Sickness* will then have to be treated as a cause of weakness and failure in military and naval operations, irrespective of the mortality which it occasions.

Having thus ascertained the leading facts relating to disease as caused by war, I shall next inquire what science and art have done in times past to save the lives of soldiers and sailors; and I shall conclude by such general observations on England as a great naval and military power, as my inquiries may seem to warrant.

This being the plan of the course, I propose to arrange the lectures themselves, as follows:—In what remains of this lecture, I shall treat of the lessons applicable to war which our experience in peace supplies. In the two lectures that follow, I shall endeavour to ascertain the losses inflicted by disease when measured by those caused by actual fighting, in the Navy first, then in the Army; and in my last lecture, I shall show what science and art have been able to do on behalf of the fighting man.

This is a large programme; perhaps a rash one. I lay it before you, not without misgiving lest, in trying to carry it out, I should fall far short of my own wishes and your just expectations. But I derive some encouragement from the fact that an important part of my undertaking—that, namely, which relates to death by the sword and by sickness, in army and navy,—has been rendered comparatively easy by the condensed summaries of those who have preceded me in this kind of inquiry. I allude especially to two papers by my friend and fellow statist, Mr. Hodge, late President of the Institute of Actuaries, read at meetings of the Statistical Society in the years 1855 and 1856, and published in

the eighteenth and nineteenth volumes of the Society's Journal. Embodying, as they do, the results of laborious study and extensive reference to original records; and presenting us with figures which are not mere summaries of facts, but truths clothed in numbers by an intelligent and accomplished actuary, I shall not only quote them with confidence, but, in consequence of the use I am able to make of them, shall be free to devote more time to those other inquiries which come within the scope of these lectures.

In reference to those other inquiries, I will only say at present, that I shall in these lectures, as in those given at King's College, always prefer a condensed abstract of some one narrative or treatise relating to some instructive discovery, combat, expedition, or campaign, to a less lively and graphic statement of the results obtained from the study and comparison of many documents bearing on the matters in question. To those who have read my first eight lectures, the accounts given of the Plague at Eyam, of the Devonshire Colic, of the Scurvy at Millbank, and of Anson's Expedition, will serve as illustrations of my meaning.*

And now, I address myself to my programme; and, first in order, to the question, whether there are any experiences relating to health impaired, and life sacrificed during times of peace, which admit of application to the state of war? In other words, is it probable, from what we know of peace and its dangers, that the state of warfare, divested of that part of it which consists in killing and wounding, would prove destructive to health and fatal to life?

To answer this question aright, we must first form a clear conception of what war, in the very essence of it, is.

* "Public Health," Part I., Lecture IV., p. 93; Lecture I., p. 9; Lecture VI., p. 146, and p. 154.

Is it not the bringing one crowd of trained, disciplined, and armed men into fierce and angry collision with another crowd? If the war is waged by sea, the crowd is compressed into the narrow limits of a ship, and in great naval engagements, many such crowds on the one side contend with many on the other; if by land, the crowd occupies the wider area of an encampment or of a battle-field, or one crowd in the open assaults another crowd in the fortified town.

War by sea differs, indeed, from war by land in this, that, at sea, the men, though shut up in a smaller space, can carry with them everything they need—food and water, clothes and bedding, instruments, medicine, and sick diet—at the same time that the air they breathe is often absolutely free from all admixture of noxious matter, except such as may be bred by neglect within the ship itself. But the soldier on land (even under the best possible or conceivable organization) cannot always be supplied with a sufficiency of wholesome food, pure water, good and appropriate clothing and bedding, and proper shelter, with instruments, drugs, and sick diet; while he may be forced to encounter in his encampments, or on the field of battle, an air poisoned with the special exhalations of the land. With the sailor, again, exposure and fatigue are accidents of bad weather, and therefore occasional, while they are the almost inseparable incidents of the soldier's active warfare.

Other differences between war by sea and war by land, might be sought out and indicated; but, after all that can be said on this matter, this leading feature of both conditions remains unchanged:—War is the conflict and collision of crowds—of crowds drilled and disciplined, but still of crowds. But this is not all; for it is true of army and navy alike, but of the army in a special manner, that the very preparation for war necessitates and implies the

gathering of men together into crowds, that they may be drilled and disciplined. Accordingly, the barrack and the camp of exercise, even in times of peace, are scenes of overcrowding, and of the diseases which spring out of it.

We were taught this truth, to the surprise of many and the grief of all, by the Report on the "Sanitary Condition of the Army," published fifteen years ago, which some of you will recall to mind the better if I connect with it the name of Sidney Herbert. From it we learnt the two facts we have so often had occasion to place side by side, as cause and effect—the fact of overcrowding carried to an extreme, and the fact of a mortality among our Foot Guards (taken as the extreme case) nearly three times as large as that healthy standard, the then London Fire Brigade, exhibited; and much more than twice as great as the rate prevailing among the City Police.*

It is these victims of overcrowding in time of peace, that even a rich and humane Government, like that of England, sends forth in war, to taste first the strange but unavoidable discomforts of the crowded transport, and then to face the stern realities of war itself, in the encampment, on the march, on the battle field, in the wearisome operations of attack or defence of fortified places; to occupy villages, towns, houses, and buildings far worse supplied with sanitary appliances than those of their own country; to contend with heat and cold, damp and drought, swamps and sandy deserts, and all the uncertainties, shortcomings, and blunders of a commissariat unequal, at the best, to furnish an adequate supply, always and everywhere, of food, clothing, shelter, and medicines; and especially inadequate to the regular and constant supply, in all seasons, of fresh vegetables and meat.

* The Sanitary Condition of the British Army. Contributions to Sanitary Science, No. 2.

War therefore, and especially war on land, and war as we Englishmen had experience of it from 1793 to 1815, means the transport of a crowd of picked men, drilled and disciplined under circumstances unfavourable to health, to foreign and often distant lands, to be there exposed, always as a crowd, to strange climates, inclement seasons, trying weather, fatigues and privations, and defective supplies of food, clothing, and shelter, with actual fighting as an occasional, and perhaps very rare, diversion (for such the true soldier comes to consider it).

Now, our experience of the life of man in peace supplies us with instances, many and most instructive, of health undermined and life shortened by the simple fact of men being pent up in narrow spaces,—mustered into crowds. The word *overcrowding*, so common in Sanitary Reports and Treatises, is, in itself, an evidence of the frequency of the occurrence; and, in these modern times, we have been able to throw our experience into the shape of a formula which expresses the direct relation between density of population as a cause, and disease as a consequence. And this density of population, this overcrowding of men, is proved to be favourable not to the production only, but to the reception and spread, of disease. I speak of *men*, as it is with them that we have now to do. But that which is true of men is true also of women and children—true even of animals. Overcrowding is fatal to all living beings.

Now, overcrowding may present itself in more than one aspect—as too many houses, huts, or tents, too many streets, or lanes, or courts, on a given area; as too many persons in one house; as too many people serving in a shop or warehouse, or toiling in a workroom or manufactory; as too many sleepers in one dormitory; as too many prisoners thrust into one place of detention; as too many sick persons in one hospital, or ward of an

hospital: and in all these cases health and life are sacrificed.

These cases of overcrowding may be arranged in three distinct categories. First of all, we may group together, as forming one class, the cases of the shop, warehouse, workroom, factory, or dormitory, in which men are assembled in undue numbers, but, as a rule, exposed to no other unwholesome influences than those that emanate from their own bodies (the case of the dormitory), or from these in conjunction with the heat, dust, and chemical effluvia which are given out in the course of certain processes of manufacture. Then we have the case of the overcrowded dwelling, of which the inmates are exposed, not only to the poisonous products of respiration in sitting-rooms and bed-rooms, but also to such noxious effluvia as may arise out of a damp soil or defective drainage; and lastly, we have the case of the hospital, in which infectious forms of disease originate and spread among the subjects of accidental injuries or of operations.

Now, setting aside, as common to all these forms of overcrowding, the augmented liability to the reception and spread of all infectious maladies, we recognise, as proper to the first, pulmonary consumption; as belonging to the second, the several forms of continued fever; as pertaining to the third, erysipelas, pyæmia, malignant ulcer, and hospital gangrene.

In the densely peopled towns or villages, which soldiers are so often constrained to occupy, the soil beneath the houses and around them is often reeking with corruption, sodden with the damp products of decay; and these, not only become parents of fever and nurses of all sorts of pestilential maladies, by polluting the air, but also, as we now know, by poisoning the waters of wells or streams with the seeds of dysentery, cholera, and

typhoid fever, and probably of every form of contagious malady.

There is another and most fruitful cause of disease, of which we have had painful experiences in times of peace, and among classes of men devoted to peaceful pursuits. I mean food, insufficient in quantity, or wanting in the essential elements of all sound dietaries, fresh meat, vegetables, and fruits. Nor ought I to omit to mention one other cause of disease in soldiers and sailors on which our experience of men following peaceful avocations enables us to throw light. I mean that over-exertion to which all fighting men must be so often exposed in actual combat: soldiers in forced marches, retreats, and sieges; sailors in stormy weather.

We have, therefore, at least four grand causes of disease with which we are familiar in times of peace, that are pretty sure to be brought into play in warfare—overcrowding, with its three leading varieties: impure water; insufficient or improper food; and over-work.

I will speak of these in turn, and illustrate them by cases in point, selecting, by preference, instances in which the sacrifice of life has been on the largest scale. And first, of *overcrowding*, beginning with that extreme form of it which consists in forcing into a narrow space a number of culprits, or captives. Such a case occurred in London in 1742, when the High Constable of Westminster committed twenty-eight persons to the Round House, St. Martin's, and Bird, the keeper, forced them into a place called the Hole, not more than six feet square, and scarce five feet ten inches high, with the windows close shut. In this narrow space four women were suffocated. The keeper was committed to Newgate, tried, condemned, and sentenced to death—a sentence commuted for transportation.*

* Gordon Smith's Principles of Forensic Medicine, p. 221.

Overcrowding carried to this point of suffocation is perhaps rare, even in war; but that degree of it which occurred at Calcutta in 1756 may be expected to happen as a common incident of warfare, and I therefore ask your attention to a brief abstract of the facts taken direct from the well-known narrative of Mr. Holwell.

One hundred and forty-six prisoners—soldiers, sailors, militia (black and white), officers and men, English, Dutch, and Portuguese, with many gentlemen of the civil service, and one native woman, all of whom were exhausted by continual watching and action, and many wounded, at eight o'clock on the evening of June 20th, 1756, were thrust into a space measuring about eighteen feet each way, having two windows, strongly barred with iron, on one of the four sides, and they were kept in this *Black Hole* till six o'clock the next morning. In other words, 146 adult human beings were shut up in a close sultry night, during ten hours, in a den affording to each inmate barely forty cubic feet of space. A few, who clung to the bars of the windows, or were pressed towards them, had some access to fresh air; while these, and some others, received frequent scanty supplies of water after the first hour had elapsed.

Of the 146 prisoners who were thrust in alive, 123 were dead when the prison doors were opened, and only twenty-three survived. Some had been smothered, some were pressed or trampled to death, some (wounded and unwounded) had died exhausted.

As the feelings and symptoms of men thus cruelly circumstanced must prove both interesting and instructive, I will give you the most condensed account I can of them, beginning with those shared by all, or by most; and then passing on to Holwell's account of his own sufferings.

After a few minutes, they all broke out into a most

profuse perspiration, followed by a raging and constantly increasing thirst, which, before the lapse of an hour, had grown intolerable, and was complicated with difficult breathing. The air of the place assumed a strong, pungent, ammoniacal odour. All who were not near the windows grew outrageous, and many delirious, and there was a general cry of *water, water!* This was passed through the windows in hats, but most of it was wasted, and it was thought to have done little good.

At the end of three hours and a half, the "much greater number" of the survivors were "in an outrageous delirium, and the others quite ungovernable, few retaining any calmness but the ranks next the windows." As the water seemed to increase their sufferings, the cry was now *air, air!* and for this they struggled violently but hopelessly.

Holwell lay for a long time insensible, and was therefore indebted to the survivors for the rest of his account. But he says that the particulars mentioned by some of them "were so excessively absurd and contradictory" as to convince him that "very few retained their senses;" or failed to lose them "soon after they came into the open air, by the fever they carried out with them."

On the second day after their release, the survivors were marched in fetters, under an intensely hot sun, and lodged under a small open verandah. Here all of them "broke out in boils all over their bodies," which Mr. Holwell characterized as a happy circumstance attending "every one who came out of the Black Hole." And here I take occasion to note the fact, that this is not the only case of boils resulting from poison introduced into, or generated by, the body. The hardships attending shipwreck, vaccination in rare instances, and the poison of the Oriental plague, in a majority of attacks, issue in this affection of the skin.

Holwell describes his own symptoms somewhat more in detail. He speaks in succession of the profuse perspiration, the raging and growing thirst, the difficult breathing, followed by exquisite pain in the chest and violent beating of the heart; of his despairing rush to the window, the quick relief afforded by the fresh air, his craving for water, and how he drank it without refreshment. Then we see him trying to drink his urine, but disgusted by its intense bitterness; yet finding the drops of perspiration sucked from his shirt-sleeves soft and pleasant as Bristol water. Next we see him sore tempted to use his penknife as an instrument of suicide, but summoning courage to resist and live on, and retaining sense and feeling enough to give his place at the window to a naval officer, and, by a last effort, struggle back into the den. Here he suffered no pain and little uneasiness, being conscious only of breathing as from a "bowl of hartshorn," and of passing gradually into a state of stupor. One more effort to improve his position and he falls insensible; and so remains till he is sought for and found under the dead, showing some signs of life. On being placed in the window he is recognised by the Surajah-Dowla, who orders the release of the survivors.

When Holwell came out, he describes himself as in a "high putrid fever," too weak to stand. After undergoing the fatigue of being carried from place to place, he and three others are loaded with fetters on the morning following their release, and he passes the night in dripping rain, and gains relief from his fever by an outbreak of large painful boils covering him from head to foot. Galled by his fetters, his legs streaming with blood, and compelled to march in a scorching sun, his right leg and thigh became the seat of a painful inflammation; he has a fresh attack of fever; and, at length, a regular fit of the gout

in the right foot and ankle, the first and last he ever had, forms a fitting climax to his sufferings.

To some such sufferings must warfare often expose the prisoner, and even the victorious soldier himself, when billeted on the inhabitants of towns and villages already crowded, as well as the unfortunate people forced to take shelter from showers of shot and shell in the cellars of their houses.

From cases of overcrowding, carried to the point of suffocation ; from cases in which, as in the Round House at St. Martin's, the space, if its dimensions are rightly stated, would barely allow the inmates to stand, or, as in the Black Hole at Calcutta, to squat upon the ground ; or those cases again in which, as in the county jail at Warwick, in Howard's day, thirty-two felons fettered in a crowded dungeon, twenty-two feet wide, "were forced to stand up (and take a sort of miserable night-watch) while the others slept," I pass on to those in which, day after day, or night after night, the available space, in rooms generally of low pitch, does not exceed that needed for the recumbent posture, so that in the case of sleeping-rooms the floor may be said to be paved with narrow beds, touching each other. Need I tell you that this state of things, or something approaching it, or even going beyond it, has been found to exist in the houses and buildings most severely visited in all our epidemics, whether of home-growth, or imported. Such places were the homes of the jail fever, such are the haunts of the typhus of our own day, such the favourite resorts of the cholera, such the breeding-places of the fatal diseases of infancy and childhood, and of the pulmonary consumption of the adult.

I have at hand notes of cubic spaces rising by easy stages, from the 8 of St. Martin's Round House and the 40 of the Black Hole, through the 30 to 60 of

Marlborough-house, Peckham, formerly the Union Workhouse and busy fever-factory of the city of London; the 52 cubic feet of the most crowded rooms in Church Lane, St. Giles's, the scene of a great mortality both from fever and cholera;* the 84 cubic feet of a village-hovel in Dorsetshire, where a very fatal fever prevailed; the 100 cubic feet of the Parish-house near Launceston, a haunt of cholera; the 136 cubic feet of the Drouet establishment for pauper children at Tooting, where, in the epidemic of 1849, the cholera slew 170 children in three weeks; the 147 cubic feet in the unhealthy barracks of Dover Castle; the 150 cubic feet of the Wood Street Compter, another notorious haunt of jail fever; the 170 cubic feet of the Cambridge Town Bridewell, smitten with jail fever in 1774; up to the 202 cubic feet of a London printing-office, where I found the deaths from consumption following as fast on each other as deaths from some contagious fever might do; and the 228 of certain sick-wards of Christchurch Workhouse, where, in 1848, gangrene of the mouth prevailed.†

Setting aside the cases in which the victims were children, and fixing our attention on those in which the inmates were adults, we find ourselves in presence of two diseases in which we are specially interested—*consumption* and *fever*, the chronic and acute plagues that ally themselves in a special manner with overcrowding.

Of the dependence of consumption on this, as one of its leading causes, there can be no doubt. We have been taught this, both in the case of animals and of men. But I am not aware that we have any data by which to measure its force and efficiency. We are not able to say how many men, presumably healthy to begin with,

* Journal of the Statistical Society, Vol. xi. p. 1.

† Report on Metropolitan Workhouses. By Dr. A. Farre, Dr. Martin, and Mr. Toynbee (1848).

would perish by consumption if made to serve by day or sleep by night, or, worse still, to occupy both as living-room and dormitory—the case of soldiers—a given narrow space for a specified time.

The nearest approach that I know of to a solution of this question is furnished by the facts relating to London letterpress printers, which I laid before the Health of Towns' Commission in 1844. They are stated at length at p. 89 of the first volume of the Commissioners' first Report.

My data consisted, on the one hand, of accurate measurements and careful calculations of cubic space; on the other, of replies to simple and uniform questions having for their object to ascertain the number of men who had spat blood, and of those (often the same men) who stated that they were very subject to colds. These measurements and calculations, and these replies were the materials for the statements made to the Commission.

On summing up my facts, I found that I had questioned 320 men working in rooms of very different sizes; and that I could institute instructive comparisons between men occupying narrower and wider spaces, or working in different floors more or less freely communicating one floor with another.

All the comparisons led to the same result: the establishment of the same vital truth—that consumption (inferred from the existence of the leading symptom, hæmoptysis) and colds (doubtless comprising attacks of consumption), were uniformly rife wherever the cubic space was smallest, or the air most close, hot, and foul. I will content myself with two instructive comparisons.

Forty men worked in five rooms with 303 cubic feet of air per man; other forty in other five rooms with 789. Of the forty in the smaller rooms, five had had hæmoptysis, and six were subject to severe colds; of the forty

in the larger rooms, not one had spit blood, and one only was subject to severe colds.

My second comparison throws the 320 men into three groups of nearly equal size, all comprising more than a hundred. The first group worked in rooms affording to each man less than 500 cubic feet of air, the second had from 500 to 600, the third more than 600. Reducing all these groups to the standard of 10,000, I found that of the first group 1,250 would have spat blood, of the second 435, of the third 396; while 1250 of the first group, 348 of the second, and 198 of the third respectively would have been subject to severe colds.

These figures bring us as near as we can hope to arrive towards an answer to the question—What number of consumptive cases would result from the occupation day by day, for long periods of time, of spaces furnishing to each man less than 500 cubic feet of air, when compared with spaces supplying, let us say, more than 800 cubic feet? We have fair ground, I think, for replying that if the men occupying the larger space would lose 400 in the 10,000, those occupying the narrower space would lose at least 1200, or three times as many. Or, we may put it thus:—A body of letterpress printers 10,000 strong might be made to undergo a waste of 800 lives by being forced to work in rooms having, one with another, a less capacity than 500 cubic feet of air per man, with, of course, the existing objectionable modes of warming and lighting.

Whether this waste of life would take place in a body of 10,000 soldiers, condemned to live and sleep in rooms of the same narrow dimensions, it is, of course, impossible to ascertain. But we know that, about fifteen years ago, the barracks in every part of the United Kingdom contained rooms of these narrow dimensions. And we also know that, both in 1858 and twenty years earlier,

the soldiers of all arms, but the Foot Guards especially, were subject to a very high mortality as compared with any healthy standard.

The figures relating to both those periods—to the seven years from 1830 to 1836, and the period preceding 1858—afford data for more than one instructive comparison. Perhaps the most instructive is that between the Household Cavalry and the Foot Guards. In the interval from 1830 to 1836, the death-rate of the Household Cavalry was a little lower than that of the population of London at soldiers' ages; 150 per 10,000 of the London population, 145 per 10,000 of the Household Cavalry. But for the Foot Guards it was 216 in the 10,000! And though the deaths from *fever* were nearly the same in the two corps, the first suffered a mortality by pulmonary consumption of 81 in the 10,000, the second of 141. The later returns show a marked improvement in the health of the Household Cavalry, but a slight amendment only in that of the Foot Guards; for the annual death-rate in 10,000 was 110 in the one, and 204 in the other.

The difference in the death-rate by consumption (81 in the Cavalry, 141 in the Guards) coincides, be it observed, with the fact that the Horse Soldier is both soldier and groom, and with this other fact that the cubic space allotted to the one happens to have been nearly a fifth larger than that assigned to the other. Indeed, prior to 1847, the difference was nearly one-fourth.

This is all I am able to say on this very important subject. I refer you for fuller information respecting it to a lecture of mine "On the Sanitary Condition of the British Army, and especially on the Want of Space in Barracks," originally published in the second volume of the Journal of the United Service Institution, but since issued in a separate form; and pass on to that form of

overcrowding which consists in too many houses, or other erections, on a given space, with the impurities which commonly collect in and around them.

I may treat this subject very briefly ; for it is matter of simple notoriety that such overcrowding, with such unclean accompaniments, has been associated, in every period of our history, with the most destructive pestilences : with the Black Death of the fourteenth century, the Sweating Sickness of the fifteenth and sixteenth centuries, the Plague of the sixteenth and seventeenth, the Jail-distemper which showed itself so often and in so many places during the fifteenth, sixteenth, seventeenth, and eighteenth centuries, the Cholera of our own times, the Dysentery which figures so constantly in the London Bills of Mortality, and the continued fevers, which, under so many names (as the Spotted Fever and Parish Infection of the old bills, and the Typhus, Relapsing, and Typhoid Fever of our more exact nomenclature) have always been the scourges of the crowded and uncleanly members of our population.

Of the exact loss of life which these several pestilences inflicted on our ancestors we have few accurate and trustworthy records. The ravages of the Black Death have been roughly set down at 9 in 10 of the populations attacked ; the Plague, as it occurred in London, was reputed to have destroyed a fifth part of the inhabitants ; and the Jail Fever and Small-pox certainly proved very destructive to life. One very accurate record, showing what ravages one of the old pestilences might commit, we do possess in the history of the Plague at Eyam, in 1665. There, in the space of thirteen months, it swept off 267 in 350 inhabitants, or about 7 in 9, and out of two neighbour families (the Talbots and the Hancocks) numbering 15, carried off all but one.*

* See "Public Health." Part I., Lecture IV., p. 93.

These figures certainly lend an air of probability to the very highest estimates of the ravages of the Black Death—an aggravated form of Plague—that occurred more than three centuries earlier, when all the causes that promote the fatality of pestilences, were certainly more extensively diffused and more intense in their operation.

Overcrowding, as it has prevailed in civil hospitals, both here and in France, and the fearful mortality to which it formerly gave rise, is also a matter of notoriety. We are able to point out among its effects the early deaths of infants from convulsions, the fatal puerperal fever of women, the miscarriage of wounded persons and the subjects of operations, through erysipelas, pyæmia, and hospital gangrene, and the spread from patient to patient of every kind of contagious malady.

The baneful consequences of this form of overcrowding were but slowly recognised in England, still more slowly in France. How our military hospitals lagged behind our civil ones in this respect may be inferred from measurements and calculations made in 1857. While ten London hospitals showed an average cubic space of 1,472, and a minimum of 800, and twenty provincial hospitals an average of 1,075 and a minimum of 653, forty-six military hospitals yielded the disgraceful average of 655 (the minimum of the provincial hospitals), and 400 as a minimum (being just half the least cubic space in any London hospital).*

I must not quit this subject without alluding to that overcrowding of ships which sometimes takes place in times of peace, though it is comparatively rare in vessels of war.

Of this overcrowding, accompanied by that disorder

* See Tables appended to "The Sanitary Condition of the Army."

and neglect of cleanliness which place it in the same category as the overcrowded town or village, we had some lamentable examples in the year 1847, when the Irish Famine Fever was prevailing, and emigrants were leaving Ireland for America in very large numbers. We have it on the authority of the Montreal Board of Health that our emigrant vessels were allowed to ship two or three times as many passengers as the same vessels would have dared to carry to a United States port; and these figures show the results of this procedure. In ten vessels arriving at Montreal in July, 1847 (four from Cork, and six from Liverpool) there were 4,427 passengers, of whom 804 died on the passage, and 847 arrived sick. The *Larch*, from Sligo, lost 108, out of 440 passengers, and had 150 sick; the *Virginius* lost 150 out of 496, and had 186 sick; and the *Avon*, the scene of horrors far surpassing those of the Black Hole of Calcutta, lost the majority of the passengers, and all the crew except two.

In all these cases, and in none more than on board the *Avon*, the terrible sickness and mortality were largely attributable to the savage habits, and superstitious clinging of the living to the dead, of their Irish passengers. Such scenes, we may hope, can never again occur, even in times of scarcity and fever. They were possible in 1847 in the absence of legislation; but the Passenger Act of 1855, amended in 1863, must have effectually guarded against their recurrence. How necessary such legislation is, and will be, so long as mercantile greed finds an ally in personal neglect of all the rules of decency and health, we may infer from what we know to have occurred as late as the year 1868 on board ships freighted with German emigrants from Hamburg to New York. I condense the following account from a summary statement of what befell the ship *Leibnitz*, a statement to

be found in a leading article of the *Times* newspaper, under date February 10th, 1868.

On the 2nd November, 1867, the *Leibnitz* sailed from Hamburg with 544 German passengers, and a cargo of wool and hides, and after a voyage of seventy days reached New York. Of the 544 passengers no less than 150 were crowded together in close proximity to this savoury merchandize, in a part of the ship known as the lower steerage, just above the keel where the bilge water collects, in a vault formed of a layer of planks loosely resting on the lower beams of the vessel, and lighted only by the rays that found their way through a hatchway on the upper deck. During the whole of the voyage, not a scuttle or bull's-eye was opened; so that in this gloomy den there was no ventilation whatever, and the air was so foul that the lanterns hung there would not burn. Of the utter loathsomeness of the whole vessel no words that I can use would give an adequate idea. The ship, as it lay in the harbour of New York, surrounded itself, so to speak, with a mephitic atmosphere which shut out the view of every object distant two or three feet. The treatment of the unhappy passengers was in all respects in keeping with the condition of the ship. The rations were scanty and bad, often rotten; the butter rancid, the beans and sour-krout thrown overboard, even by the hungry, and the supply of water to people sweltering in insufferable heat and indescribable nastiness, was only half a pint a day. Even sick passengers had no better dietary; they had no doctor on board, and no medicines after the first fortnight. They died apace, like rotten sheep, and their corpses were kept in the steerage for four-and-twenty hours. Whole families were swept away; husbands and wives died, leaving their unprotected children who, when asked where their parents were, pointing to the deep water, answered with tears and sobs, "Down

there." It is with a sensation of surprise and relief that we find only 108 deaths out of 544, laid to the charge of all this neglect and cruelty. So wonderful is the power of resistance and endurance stored up in the human body!

The drinking of tainted water is a cause of disease which is very likely to affect armies in the field, less likely to prevail in our ships of war. I speak of the taint that the water of wells and streams receives from the excreta of persons suffering from such diseases as dysentery, cholera, and typhoid fever. It is probable, as I have elsewhere suggested, that the accusations of poisoning streams and wells which have been put forth during every great epidemic, from the Black Death down to the Asiatic cholera, were not always the offspring of ignorance and panic, but, in some cases at least, the result of real observation, mistaken not as to the fact of contamination, but only as to its cause.*

The fact that the poison of disease may enter the body by this channel (in the water we drink), has, as you are aware, lately received an unexpected confirmation, and the principle an important extension in the group of cases of scarlet fever which Dr. Ballard not long since succeeded in tracing to milk tainted by persons recently and imperfectly recovered from the disease.

Insufficient or improper food is the last of the three leading causes of disease of which we have had large experience in time of peace, and which is also one of the great dangers of a state of war. Scurvy and the dysentery so often associated with it, following on the defective supply of wholesome vegetables and ripe fruits, were once the scourges of our civil population, no less than of our armies and fleets. They attacked the prisoners in Mill-

* See "Public Health," Part I., Lecture II., p. 58.

bank so late as 1822,* and, even at the present day, it is not possible to contemplate a war of any duration without the most serious misgivings lest our commissariat should break down in this most difficult of all its arduous duties.

To form a clear idea of the possible ravages of scurvy, it will suffice to call to mind such cases as that of the English garrison at Oswego, in the year 1756, losing 200 out of 700, and having the whole remnant, with the exception of 80, unfit for duty; or that well-known case of the three ships of Anson's expedition losing, in less than nine months, 626 out of 961, and the solitary *Centurion* returning to England with much less than 200 of the original crews. How little of all this loss of life was due to actual warfare we all know; how much to aged, invalid, and ill-assorted crews, and the close confinement rendered necessary by boisterous weather, it is not easy to say.†

Of over-work, as a cause of sickness and mortality, I can only speak very briefly. That it is a very real and efficient cause, both in peace and war, there can be no doubt. To show what it can effect, by an extreme instance, I will refer you to my lecture on the Evils of Night-work and Long Hours of Labour in the case of the journeymen bakers of London. Let it suffice to state one fact. The compositors, to whose case I have already referred, I found to have spat blood in the ratio of twelve and a half in the hundred; the bakers in the ratio of thirty-one in the hundred.‡

In treating of over-crowding in its several degrees and forms, of tainted water, and of short or defective supplies of food, as the most constant and fatal incidents of war-

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* See "Public Health," Part I., Lecture VI., p. 146.

† See "Public Health," Part I., Lecture VI., p 154.

‡ Contributions to Sanitary Science, No. I.

fare, I by no means undervalue those other foes of the fighting man which bad customs, bad management, bad plans, bad strategy, are constantly creating. We know how the sacrifice of utility to show has affected the soldiers' clothing, how the unchecked greed of contractors has afflicted him with bad clothes and rotten food, how little account has been taken of the salubrity of the countries to which he has been sent, how little of the seasons and their requirements. He has had his feet galled and crippled, he has been choked with a rigid leather stock, his chest has been constricted, his shoulders weighted and galled with a heavy and ill-poised knapsack; he has been exposed to pinching cold in summer clothing, has been made to march under a tropical sun without protection for the head, and has had to face the dazzling snows, or hot-glaring sands, without any attempt to save his eyesight.

How the soldier himself has carried with him, wherever he has gone, that gluttony and intemperance which form the standing disgrace of our whole population, all our military histories tell us; and I shall have occasion to allude to it once at least in a future lecture.

Fortunately, the time has passed when the armies of England first bred disease abroad, through manifold neglect of all wholesome habits and appliances, and then imported it among our civil populations; and that time, too, when our armies and fleets, recruited largely from our prisons, carried with them the terrible jail-distemper, and the equally formidable and then unmitigated small-pox.

I shall have more to say on this interesting topic in my last lecture. In the two that follow, I shall lay before you (to serve as standards of comparison, whereby to measure other wars, past and to come) the figures relating to the destruction of human life during the long fierce struggle, by sea and land, that ended in 1815.

LECTURE X.

THE NAVY.

I DEVOTED the greater part of my last lecture to the establishment and illustration of certain leading propositions relating to warfare generally, but especially to military operations, which, if set forth in due form, would be to the following effect :—

1. That war consists in the bringing of one crowd of trained, disciplined, and armed men into fierce and angry collision with another crowd.

2. That during the preparation of these crowds for war, they are subject, both in barrack and hospital, to an overcrowding which impairs health and destroys many lives.

3. That among the diseases so produced, *pulmonary consumption* and *fever* hold the first place.

4. That, in actual warfare, overcrowding in its several forms and degrees, and with accompaniments which our experience in times of peace proves to be most fatal to health and life, must come into frequent play.

5. That such overcrowding, with supplies of food deficient in quantity or in the essential elements of fresh meat, vegetables, and fruit; water impure, and perhaps tainted by human excreta; clothing ill-adapted to the form, or unsuited to the climate or season; exposures and fatigues, inaction and *ennui*, gluttony and intemperance—these, in all degrees and in every combination, suffice of themselves to account for much of the disease and loss of life which attend on war.

Whether the mortality, due to causes such as these, is largely increased by the casualties of battle, and, if so, to what extent, is one of the questions which will receive an answer in this and the following lecture; for I shall use the casualties of actual fighting—the killed and wounded—as my standard of comparison by which to measure the losses by disease.

In any inquiry into the ravages of disease, and loss of life occasioned by war, it is natural, I think, to begin with the navy; for the facts relating to this branch of the public service are more simple and should be more easy to ascertain than those that relate to the army. The fleet, or the ship, is more definite and self-contained than the army or the regiment.

Beginning then with the navy, we have three orders of facts—three kinds of warlike contest, of which we must take cognizance, if we would ascertain the loss of life that results from actual fighting:—I mean actions between single ships, actions between fleets or squadrons, and naval attacks on land defences. I will state briefly what the loss of life entailed by these three warlike procedures is.

Mr. Hodge, in his paper on the navy, gives the particulars of thirty-five actions fought by English ships against French or American, in which eighteen were decided in our favour by the capture of the enemy's vessels, eleven against us, and six were indecisive.

These thirty-five actions seem to have been chosen out of the 576 which took place between 1793 and 1815 (being at the rate of more than one a fortnight for the whole of that long contest), as furnishing the most precise details of length of struggle and loss inflicted and sustained, in actions bravely contested.

I will give you the results for our own vessels per 1000 men engaged:—

Loss in killed 56; in wounded 144; total casualties 200; or 20 per cent.

From the same source I obtained the particulars of twelve actions between fleets or squadrons :—

The loss per 1000 of our men engaged was in killed 16; in wounded 52; total casualties, 68 per 1000.

Six naval attacks on land defences, entailed on us a loss of 26 killed, and 57 wounded; or 83 casualties per 1000 of our men engaged.

These figures I will arrange in order, beginning with the lowest :—

Actions between Fleets and	Killed.	Wounded.	Total.
Squadrons	16	52	68
Attacks on Land Defences ...	26	57	83
Actions between single ships ...	56	144	200

If now I bring together these three forms of naval combat, I obtain, as the losses per 1000 sustained by 121,654 English sailors, 21 killed; 59 wounded; and 80 killed and wounded.

A near approximation, easy to bear in mind, would be:— killed 2; wounded 6; killed and wounded 8 per cent.

These averages may, of course, be very largely exceeded. Thus (to take an example from each class), Sir William Hoste, in his action off Lissa, in 1811, suffered a loss, in killed and wounded, of 212 per 1000; Nelson, in the attack on Copenhagen, in 1801, of 118 per 1000; while the *Shannon* in her duel with the *Chesapeake* in a quarter of an hour lost at the rate of 271 in the 1000 killed and wounded, or 18 in the minute; the heaviest loss, if measured by time, our navy has perhaps ever sustained.

I may mention, in passing, that Lord Exmouth, in his attack on Algiers, in 1816, lost in killed and wounded, 147 per 1000. At Sebastopol our loss was only 29 per 1000.

There is one kind of naval operation which I have not yet noticed, because the figures that relate to it have not been put into a form admitting of comparison with those I have just laid before you; I mean boat-attacks, and cutting-out expeditions. I have brought together just to serve my present purpose, the particulars of 15 such actions that took place between 1794 and 1800, eight of them in the last-named year. These actions, one of which was attended with scarcely any loss, and two with no loss at all, issued in the capture or destruction of upwards of 30 armed vessels, and the dismantling of several forts, at a cost of 15 men killed, and 87 wounded, being one man killed and not six wounded to each of the 15 attacks.

Such great results achieved at so small a loss lend some air of probability to ancient histories relating to battles on land, and to such more modern accounts as credit our starved and sick troops at Agincourt, with 10,000 of the enemy killed, and 14,000 prisoners earned by the sacrifice of forty men!

Although it is usual to apply the word "loss" to the aggregate of killed and wounded, it would be more correct to consider as lost only the killed and those who succumb to their wounds, or to operations rendered necessary by them, within a short period of the conflict. What proportion these bear to the killed we do not know. We might learn it perhaps by bringing together casual statements to be found scattered through the works of our naval surgeons and physicians.

One such statement is recorded by Trotter in his *Medicina Nautica*. It consists of a nominal return of the officers of every rank killed and wounded in Lord Howe's great victory of the 1st of June. The killed were seventeen, and the wounded forty-four, and of these forty-four, six, or about one in eight, died of their wounds. As

naval officers are much mixed up with the men in action, and the ratio of killed to wounded in the two classes does not differ greatly, I assume for the present the deaths by wounds to be an eighth of the wounded; and when we consider the slight injuries reported to the surgeon as *wounds* by candidates for "smart money," I think that this estimate is not too high. If we accept it, the figures for all forms of naval engagement taken collectively would stand thus: killed, or dying of wounds, 28; wounded, but not mortally, 52; killed and wounded, as before, 80 per 1000; or, approximately, 3, 5, and 8 per cent.

As these figures cannot be used to determine the losses caused by fighting and by sickness respectively, I must look for this information to returns of a different order. I find it prepared to my hand in a table given by Mr. Hodge, as the ultimate result of his inquiries and calculations. I will try to express his conclusions in a few words:—The royal navy, during the twenty and a half years of actual warfare, consisted of 110,180 men, on the average of all these years, and these sustained a loss of 6663. There were that number of fatal casualties in action. They had a further loss of 11,985 (little short of double the number), in men drowned or destroyed in ships, wrecked or burnt, in excess of like casualties occurring among the same number of men in peace; and 44,662 men perished by disease or ordinary accidents on board, this number also being in excess of those who would have died from the like causes in time of peace.

The last column in the table from which I quote gives the result which we, as medical men, are most interested in knowing. Let us suppose the number 100,000, to represent the deaths caused by naval warfare, over and above those which would have occurred in peace, and we shall find them distributed as follows:—

Casualties in action, 10,524.

Drowned or destroyed in ships, accidentally wrecked or burnt, 18,931.

Deaths from disease, or ordinary accident on board, 70,545.

In other words, if we take the casualties in action at 10, deaths from disease will be 70, or nearly seven times as many. If we take deaths by drowning and burning as our standard, the proportion will be seven from disease to two by those other causes.

Hitherto I have been speaking of disease—of sickness—as a cause of death, measuring its prevalence by the casualties in battle, as a standard of comparison. I have now to treat of sickness by itself, as a deduction from the number of available fighting men. My observations under this head will apply to both branches of the public service, though primarily to the navy.

This topic of sickness is not an easy one to treat, for the thing itself is subject to infinite variety, in kind and degree, and it is not possible to set up any standard of comparison to which to refer the number sick during any given operation of war.

In seeking for a standard of sickness, beyond the limits of army and navy, we should first have to reject as unsuitable all bodies of men not picked or selected as being free from physical defects. We should next have to set aside even those picked or selected men (such as our police and fire brigades), whose duties differ, as they must needs do, from those of the sailor or soldier in actual warfare. And then we should seek out, if it were possible to find it, some instance of warfare, by sea and land, in which every precaution against disease had been so carefully and skilfully taken that the resulting sickness should be the least possible.

Let us suppose such a result to have been arrived at,

in some particular instance, yet it is obvious that the figures so obtained, would only admit of application to warlike operations of the same class carried on in the same country, or district of country, at the same season of the year, and under what we cannot even imagine, the same atmospheric conditions—the same "*epidemic constitution.*" A fleet, an army, or an expedition in which both services are called jointly into play, may have to encounter an enemy more ruthless than any human foe in such a malady as the cholera or the plague; it may be suddenly prostrated by influenza; it may waste away under the slow operation of causes that find their ultimate expression in scurvy and dysentery, or in one of the many forms of fever, intermittent or continued. Or some ill-fated expedition, like the Crimean, may encounter the cholera at the very outset, and then pass in succession through the bitter experiences of scurvy and fever.

But though the attempt to establish a standard of sickness applicable to fleets or armies engaged in actual warfare must needs prove unsuccessful, we may call to mind with advantage a few of the facts respecting sickness which are best ascertained.

Take, for instance, the age of the sailor or soldier. The fact that the body does not attain its full development till about 27 years of age, is in harmony with the multiplied experience which assigns to young recruits, and especially to young soldiers, an extreme liability to sickness, when subject to the fatigues and exposures of war; while, on the other hand, that other fact that a man of 50, in civil life, is found to suffer more than twice the amount of sickness which falls to the lot of a man of 30,* —a fact obviously applicable to the case of the fighting man—will justify us in expecting an increase of sickness

* F. G. P. Neison's Contributions to Vital Statistics, p. 96.

among veterans, even after we have made every allowance for the experience and prudence which grow with age. I have elsewhere shown that some part of the excessive mortality attending Anson's expedition was due to the raw recruits, invalids, and men upwards of 70, whom he was forced to accept as part of his crews.*

Take next the condition of the sailor and soldier about to enter on the busy work of war. We know that men may be much out of condition without being placed on the sick list. They may carry with them from the crowded receiving ship or barrack the seeds of disease which sanitary neglects have sown—of consumption, which a few weeks of exposure and fatigue may ripen, of fever, which a few days may develop. And we know that it is by the falling off of the young, the infirm, and the diseased, that those armies are gradually formed of which the commander can say with truth that they are ready to go anywhere and to do anything. Such was the army with which Wellington in 1814 invaded France and marched to Bordeaux; such the army with which we were prepared to continue the war in the Crimea, had our allies been equally willing with ourselves. We have known also to our cost how soldiers sent to contract intermittent and remittent fevers in such swamps as those of Walcheren, or cholera on the road to the Crimea, may recover only to fill our hospitals at home, or swell the sick lists of the Peninsula or Balaclava.

The season of the year must also be taken into account if we would rightly estimate any special return of sickness. Though we know that here in England, and probably elsewhere, the order of the seasons in respect to sickness is by no means uniform, but subject to variation from year to year, we may lay it down, as a

* See "Public Health," Part I., Lecture VI., p. 155.

general rule, that with us sickness tends to vary directly, but mortality inversely, as the temperature. Nevertheless, under an exceptionally high temperature in summer, or an exceptionally low temperature in winter, sickness and mortality may coincide. Both may be at a maximum together. And we know too how much sickness and how many extra deaths may result from transferring troops from our temperate climate straight to such a different one as that of India at the hottest season, so as to allow no time for acclimatization.

One other illustration of the difficulty of establishing a standard of sickness is afforded by the still more remarkable fluctuations that occur from year to year; in the same seasons, or months, of different years, or in the several seasons of the same year.

Though our death registers are by no means exact measures of the prevalence of sickness, they may fairly be used by way of illustration. Let us take, then, the facts as they relate to London.* In the short period of fifteen years (from 1840 to 1854) the deaths in London, per million of inhabitants, presented, as I found, maxima and minima, of which these are examples:—

Diseases of the heart proved fatal to 530 one year, and 952 another; old age was the assigned cause of death in 911 instances one year, in 1884 another; and there were in one year 179 sudden deaths, in another 455.

The whole group of zymotic diseases was credited, in round numbers, with 4000 deaths one year; with 12,000 deaths, or three times as many, another.

If we take the diseases most influenced by the weather, we find asthma destroying 260 one year and 728 another,

* Journal of the Statistical Society. Year 1855. For a somewhat different use of the same facts see "Public Health," Part I., Lecture II., p. 40.

and bronchitis 271 and 2083, or nearly eight times as many. Dysentery is entered one year as the cause of 38 deaths, another of 163; and diarrhœa of 246 and 1522, or nearly seven times as many one year as another.

And, if we take the leading contagious maladies, as measures of the force of the *epidemic constitution* of the air, we have typhus ranging from 615 to 1600, measles from 249 to 1122, scarlatina from 354 to 2132, and small-pox from 87 to 890, one year proving more than ten times as fatal as another.

But these remarkable contrasts of year with year are not limited to diseases that are obviously amenable to atmospheric influences; for we have purpura credited with 6 deaths and 36; carbuncle with 1 and 16; and syphilis (so important to our army and navy as a disabling malady) fluctuating between 11 and 76.

Let us now suppose the young adult males of this London population to be sifted, and those that appear healthy and well formed to be drilled as soldiers, and sent out to foreign battle fields, and we shall understand what large or what small losses they might sustain, according as the year happened to be as unhealthy as 1849, or as healthy as 1850—a year afflicted with cholera or free from it; a winter favourable or hostile to lung-disease; a summer promoting diarrhœa or checking it.

Nor are these contrasts afforded by our metropolitan death-registers more striking than those exhibited by records of sickness, of which I find a very valuable specimen in a return made by a naval surgeon, Dr. Walker, to Sir Gilbert Blane, of the attacks of sickness and the deaths that took place among some 6000 prisoners of war, in every month of the eight years from 1806 to 1813 inclusive.*

* Sir Gilbert Blane's Select Dissertations, Vol. i., p. 100.

If we take the facts by the year, we have 9 attacks per 1000 prisoners in the healthiest year, and 22 per 1000 in the most sickly; 4 deaths per 10,000 in the least fatal year, 12 in the most fatal.

If we compare month with month, we have 38 per 1000 sick in the most sickly month (March, 1807), and less than 4 per 1000 in the most healthy (September, 1811).

And, again, if we limit ourselves to the figures of the same month, we have the sickliest March of the eight, yielding a maximum of 38 per 1000 sick, and the healthiest a minimum of 11; the sickliest October of the eight, 21 per 1000, the most healthy 4 per 1000, or less than a fifth.

The most striking contrast afforded by any one month is, however, to be found in August. In the year 1807, that month was credited with 25 per 1000 attacks of sickness, and 5 in 10,000 deaths; but in 1812, there were only 3 sick men in 1000, and not 2 deaths in 10,000. The sick, therefore, were more than eight times as numerous in the August of 1807 as in that of 1812.

If we condescend to days—to the sick at any one time—we find Dr. Walker stating that he had once as few as 7, and once also as many as 175. I find that the monthly average for the whole period is only 14 per 1000, and for the last four years less than 10 per 1000. The deaths for the whole eight years were but 1 per cent. per annum.

It may be interesting to add, that I find the four warmest months of the eight years, taken together, yielding 112 per 10,000 sick, and 6 per 10,000 of deaths; while the four coldest yield 169 per 10,000 sick, and 16 per 10,000 dead; the four temperate months giving the intermediate figures of 136 per 10,000 sick, and 8 per 10,000 dead. But many of these prisoners were natives of climates warmer than ours.

These figures are, I think, of special interest, for they relate to men of mixed nationality, picked fighting men, many of them natives of warmer climates, suffering captivity at a place (Norman Cross) situate in a marshy district, but with the combined advantages of "cleanliness, free circulation of air in the building, nutritious food, and regularity of life."

Well might Sir Gilbert Blane cite these facts and similar ones from the depôt at Dartmoor (with its 74 sick in 7,500 prisoners), and the ships in Hamoaze (with their 61 in 6100, on the 20th August, 1812), as a triumphant refutation of M. Dupin's "*bitter invectives*" against a government which had treated him with rare indulgence and liberality, and a people who, whatever their other faults, have never been justly accused of cruelty to vanquished foes, unless, as in the great Indian mutiny, it be under the direct influence of that surprise and panic which has ever been found to breed a short-lived cruelty in nations naturally the most humane.

As the figures I have just brought forward do not encourage us to search further after a standard of sickness to which to refer the state of our fighting men in actual warfare, I am reduced to the necessity of placing before you some of the most striking contrasts which the state of war, by sea or land, has afforded. I will take the navy first, then the army.

In treating of sickness in the navy during the war of the Revolution, I cannot, I think, do better than refer to the "General Abstract of the Health of the Fleet" from January 1, 1794, to December 31, 1797, as given by Dr. Trotter in his *Medicina Nautica*. But as the year 1794 was that in which the glorious victory of the 1st of June was won, I ask you to let me pause for a moment while I offer a few preliminary remarks upon an event which was curiously influenced by the sickness prevailing in the two hostile fleets.

Never had England more felt the want of some great warlike success than in the beginning of the year 1794. Though our soldiers and sailors had fought well, and done their duty bravely whenever they had met their foe, Toulon had succumbed, more through the fault of our Spanish allies than of ourselves; and in Holland after many a glorious feat of arms, we had yielded to overwhelming force; and we had but half completed the conquest of Corsica. It was vain to look to our army for the success we so much needed; for in that direction the prospect was growing worse and worse. The allies, once within 160 miles of Paris, had lost their opportunity of finishing the war at a blow; and France outnumbering the aggregate of all their forces in the proportion of more than two to one, had learnt the lesson of concentration, and had practised it with fatal success, against armies moved by many masters and distracted by jealousy and conflicting interests. Russia, Prussia, and Austria, showed themselves more intent on partitioning Poland than on conquering France; and Austria, the most loyal and constant of our allies, was crippled, and almost paralysed by her Aulic Council. So that France, practising her new-learnt lesson of concentration, with commanders who had before their eyes the alternative of success or the guillotine, and troops conscious that their lives were not in greater danger on foreign battle-fields than they would have been at home, went on from victory to victory, from one success to another. We then, here in England, were oppressed by a sense of failure, and stood, as I have said, sadly in need of some signal success which would inspire us with confidence and hope, and nerve us, and knit us together in a firm determination to face the costly, hazardous, and uncertain future.

In this, our hour of danger and difficulty, the first gleam of sunshine came to us from the sea, on the glo-

rious 1st of June. On board Lord Howe's fleet there were no discordant nationalities, no conflicting commands, and, what was hardly less important, there was no sickness. Let us see how this happened. About six weeks before the date of Lord Howe's victory, Dr. Trotter was appointed physician to the fleet, with the confidence of his commander and full powers to act. Early in the year, and prior to his appointment, fever had been prevalent and fatal in several of the ships; and in one of them it had been associated with the flux, and caused 270 attacks of illness, and ten deaths. This happened, as I have said, early in the year; but as late as the 16th April, when Trotter inspected the fleet, there was a sick-list of 725; 53 sailors were confined to bed, and 21 were proper objects for an hospital. By prompt and judicious measures, matters were so mended that on the 1st May (a fortnight later) the fleet was reported to be in perfect health; and so continued till the day of battle, when it bore into action 17,241 effective men, to combat in the same number of ships, armed with as many guns, but firing heavier broadsides, 2500 more men. But of the French crews a part, as I shall presently state, were anything but effective. The tangible fruits of Lord Howe's victory were seven ships of the line, including the notorious *Vengeur* which sank the same evening with 320 men on board. In the remaining six prizes the number of killed and wounded was largely in excess of our total loss in the whole fleet.

I have told you how the physician to the fleet had helped to "organize victory," by placing in the hands of his gallant chief the living *matériel* of the fleet in a state of first-rate efficiency. I will now tell you what the French had been doing. They had, as I have said, the same number of ships, but their crews were larger, and their broadsides heavier. They were well supplied too with

"medicines, surgeons, and assistants," and had "many articles of comfort unknown in our navy," "even live-stock." They, too, had had much sickness on board their ships, but they had not shaken themselves free from it. They took sick men by the hundred into action; so that when Trotter was sent to visit and report upon the prizes, he found fever and scurvy on board them all. Let us take the *Sans Pareil* (the Peerless) as a specimen. She sailed from Brest six weeks before, about the time that Trotter was making his inspection of our fleet. She had 1000 men on board, of whom many died early in the cruise, and sent a hundred fever cases to a corvette. The number of deaths was very great. After the battle we took from this one ship alone upwards of 200 prisoners, most of them suffering from scurvy and spotted-fever, into the *Majestic*. This fever-stricken vessel was but a sample of the seven prizes, for the *Vengeur* was infected, and Trotter found the rest "sickly," and afflicted with a fatal contagious fever; and this fever had the usual concomitants, and acknowledged the usual causes. The ships were "dirty to an extreme degree;" and Trotter learnt that in the *Sans Pareil* the lower deck-ports had never been opened from leaving the harbour till the day of action.

Here, then, in this formidable French fleet we had disease, with filth and foul air, for associates, organizing not victory but defeat—supplying the French, if they would condescend to so mean a thing as truth, with a real explanation of part of their miscarriage, if not of all. But the flattering fiction of the unconquered *Vengeur* was far more to their taste than the unsavoury reality. For my part, I shudder as I think, even at this distance of time, of the glorious 1st of June, as it might have been had the state of things on board the two fleets been reversed; had the French, who never fought better, been

reinforced by health, and we crippled by disease. If we would know how terrible a thing this fever was, we must pursue the history of this great fight a little further. I have said that one of our ships, the *Majestic* received more than 200 French prisoners from the *Sans Pareil.* The crew of the *Majestic* had been set to superintend the cleansing of the lower deck of this unsavoury French ship, and a lieutenant and two midshipmen so employed fell early victims to the infection. Then, from this ill-fated *Majestic* the pestilence spread to the other ships, affecting ten severely and five slightly. So prevalent and so fatal was this fever that, from the 11th of June to the end of July, 800 patients were sent to Haslar Hospital; of whom 40, or 1 in 20, died. At the same time, the French prisoners in the neighbourhood of Portsmouth and Plymouth were dying fast of this same fever, infecting nurses and attendants, and their guards of the Middlesex Militia. When towards the end of September this work of destruction, the terrible revenge of France, had come to an end, Trotter sums up the painful but instructive history in these words, "Thus ended an infection, the most general that was ever spread in a large armament, and which, under other situations of season and discipline, might have proved fatal to the Channel Fleet of Great Britain."

This is a grand and touching example of disease in one of the three leading characters in which I recognise it—disease the impoverisher, disease the disorganizer, disease the demoralizer. Here we have an illustration on a large scale of disease the disorganizer, in perfect harmony with all our experience. Disease it is that lets the enemy into besieged places, as at Kars; disease that mars the most promising expeditions, as at Walcheren; it was disease that retarded Wellington's career of conquest; it was disease that fought for the enemy at

Sebastopol. Lord Howe's fleet encountered another enemy of the same class in the *Influenza* of 1795. In the space of six weeks (from January 18th to February 28th) 39 vessels had 5149 severe cases on the sick list, being an average of 132 per ship, the *Orion* and *Barfleur* having respectively 480 and 450. In this same year 1795, 200 men were seized in one night on board the *Fortitude* a ship belonging to the squadron of Admiral Kempenfelt. Such an attack of Influenza occurred among the Channel Fleet in the spring of 1782; and, to come down to more recent times, the *Canopus* in Plymouth Sound, had two-thirds of her crew struck down in one day; men, as Dr. McWilliam told us, in the prime and vigour of life and health, in high spirits at the prospect of being paid off, in an hour or two prostrated in mind and body, as if by some sudden blow, or unexpected reverse of fortune.

Dr. Trotter's abstract for the years 1795, 1796, is largely devoted to details respecting the scurvy. The severe winter of 1795 had been very fatal both to vegetation and to animal life. The price of provisions rose; fresh meat was served out to the fleet only once a week; and by the middle of March a general disposition to scurvy showed itself. This the doctor set himself to counteract by substitutions in the dietary, and by great and continuous exertions to procure vegetables and fruits, and lemon-juice for the sick. But in spite of all his efforts, the disease became very general. Seamen were attacked with scurvy at Spithead; whole ships' crews were overrun by it; whole squadrons had the disease in every ship, the hospitals filled with "scorbutics" from the shipping at Spithead, as well as from vessels returning at sea; and, in a word, the disease attained such a height that "if assistance did not soon arrive, there was danger that the whole fleet might be rendered inactive."

This was the state of things on the 20th April, 1795. It led to increased exertions on the part of Dr. Trotter, the whole country was laid under requisition for fresh meat, vegetables, salads, and apples; and the hospital ship *Charon* from which these things were largely dealt out, came to be called the *Doctor's Garden.* But the scurvy, in spite of every exertion held its ground, survived the heats of summer, and passed on into the year following, so that it was not till November 20th, 1796, that ships returning from sea could be reported in "perfect health."

Some idea of the prevalence of the scurvy may be formed from the statement that, from the middle of March to the middle of June, 1795, not less than 3000 cases, unfit for duty, had been cured on board ship, by the lemon or its juice, and that on the 31st of August Admiral Harvey's squadron of ten ships arrived at Spithead with 1085 scorbutic patients.

Blended with these accounts of the prevalence of the scurvy and of Dr. Trotter's valiant and persevering efforts to subdue it, we have incidental proofs of the curative power of lemons and their juice, and of the preventive efficacy of a liberal mixed diet. I must limit myself to one of these.

On April 17th, 1795, a squadron under Admiral Colpoys arrived at Spithead, with scurvy in every ship, and about the same time Rear-Admiral Harvey arrived, with four ships from the North Sea, in a still worse plight; for one of his ships, the *Prince of Wales* after landing fifty men at Deal Hospital, five of whom perished in the boat, brought a number ill to Spithead. But the *Thunderer* one of these four ships, returned in perfect health; for the crew, having lately shared some prize-money, "had furnished themselves amply, for the cruise, with every delicacy, even to live stock."

It will be seen, then, that our old foe, the scurvy, which had caused the total miscarriage of many a promising expedition in the 17th and first half of the 18th centuries,—of Sir Francis Wheeler, in 1693, Admiral Hosier, in 1726, and Admiral Vernon, in 1740—which so cruelly afflicted the crews of Anson's ships in this same year 1740, and to which Sir Gilbert Blane attributes six *drawn battles* that ought to have been victories, in the course of the Seven Years' War, and the American War, might still, in seasons of scarcity, succeed in invading our ships, squadrons, and fleets, and in resisting, for nearly two years, the most energetic and best directed efforts of medical science.

Nor, in spite of Howard's labours, and the wholesome legislation of 1774, were we yet able to shake ourselves free from another ancient foe, the Jail-distemper. For we learn that the *Colossus* commissioned at Plymouth in the autumn of 1796, took on board a crew entirely composed of raw Irish landsmen, the worst that ever came into a man-of-war, of whom a great part had been discharged from jails, and that three or four times during her fitting, she was infected with fever, one man falling ill, and then all the members of his mess; and the disease making its appearance again in the cruise off Ushant. Nor does this appear to have been a solitary case.

There is another disease by which our sailors have often suffered through communication with landsmen. I mean small-pox; respecting which also we have several details. But during the four years 1794 to 1797, I find notices of only thirty-nine cases occurring in six ships, the largest number in any one ship being twelve. As a rule, it was not of a bad type; and was by ordinary precautions limited to the few who suffered from it, aided by the inoculation of the few sailors whose prejudices could

be overcome. The following year, 1798, however, the disease prevailed more extensively, and in one ship (the *Captain* killed seven out of the fifteen whom it attacked.

I notice, in passing, the testimony borne by Dr. Trotter to the mildness of the disease imparted by inoculation. He had operated on near 300 children without a miscarriage, and he says, that in two or three general inoculations of seamen on board the hospital ship *Charon* not one had been confined an hour to bed.

Under date May, 1797, Dr. Trotter makes a brief reference to the *malignant ulcers* which particularly affected the ships of the line, *Queen Charlotte*, *Royal Sovereign*, *Saturn*, and *Terrible*. Some of these ulcers began on spots injured by slight scratches, bruises, or burns, or by minor surgical operations, but most as a small livid pimple that quickly inflamed and spread, with intolerable pain, fever, often delirium, and sometimes buboes. The ulcers ran speedily into gangrene and sphacelus, exceeding anything the doctor had ever witnessed in surgery; for often in the short space of a day or two, the whole integuments and muscles of the limb seemed to drop away, and a caries of the bone often followed." This malignant ulcer, and small-pox, were the prevailing maladies of the year following (1798).

There is still one disease to which Trotter calls our special attention, that affords so curious an illustration of the unexpected quarters, so to speak, in which most serious mischiefs may lurk, that I must detain you while I speak of it. The disease is *Syphilis*. At the time when Trotter wrote his abstract (he speaks of the matter under date March 6th, 1795), the sailors were subject to a charge, or fine, of fifteen shillings for the cure of this disease. To avoid this payment, they would resort to some of their messmates who professed the requisite skill;

cause medicine to be brought from land; consult itinerant quacks at the sea-ports; or conceal their state from the surgeon till they became subjects for hospital with the most dangerous symptoms. At length Dr. Trotter represented the evils of the system to the Admiralty with so much earnestness that a stop was put to the charge, and some addition made to the pay of the Surgeons in lieu of it. This much needed reform was, Trotter says, an epoch in naval improvements; for hundreds of seamen had annually fallen victims to that unwise regulation. It proved most welcome and serviceable to all parties concerned; and coupled with that other reform of the strange custom that required navy surgeons to supply their own medicines, must have greatly improved the *status* of our profession serving in the navy.

Before quitting this branch of my subject—the disease and mortality prevailing in the navy—I should like to have said something of sickness as distinguished from disease proving fatal. But the facts of this order are wanting for the whole period of the war. One contribution to a knowledge of this subject I am, however, able to make. On the 16th April, 1794, shortly after his appointment as physician to Lord Howe's Fleet, Trotter ascertained by inspection and official returns that there was a total of 561 sick men in the 36 ships that fought on the 1st of June (or six weeks later). These ships, with the *Phaeton* frigate, which was free from sickness at the date of the inspection, had an aggregate of 17,241 men. And if we take it at 17,000, we have a sick-list of exactly 33 per 1000.

Having now given you some idea of the diseases of our seamen at the end of the eighteenth century, I shall in my next lecture, pass to the diseases of the army, submitting them to the same treatment I have already adopted in the case of the navy.

LECTURE XI.

THE ARMY.

In dealing with military operations, I shall treat separately of battles and sieges, and among battles shall distinguish offensive from defensive; and in sieges, those brought to a successful issue by assault and capitulation respectively, from those that have been unsuccessful. And in every instance I shall limit myself to the losses sustained by our own troops.

In eight offensive battles fought in the interval from 1793 to 1815, by 179,500 men, we had 12 killed per 1000, and 62 wounded; our total casualties were therefore 74 per 1000.

In nine defensive battles, fought by 222,900 men, the killed were at the rate of 24 (instead of 12) per 1000, and we had 110 (in lieu of 62) wounded; total 134.

Turning from battles to sieges, I begin with those brought to a successful issue by assault; and I find the losses sustained by 62,800 British troops to have been 38 per 1000 killed, and 122 wounded; a total of 160 per 1000.

In two sieges successfully terminated by capitulation, and employing 21,000 men, we lost 8 per 1000 killed, and 34 per 1000 wounded; total 42 per 1000.

In five unsuccessful sieges, in which 52,900 troops were engaged, our loss in killed was 27 per 1000, and we had 90 per 1000 wounded; so that our total casualties were 117 in the 1000.

I will now place these five groups of figures together, in the order of total casualties, beginning with the lowest :—

	Killed.	Wounded.	Killed and Wounded.
1. Successful sieges, terminated by capitulation	8	34	42
2. Offensive battles	12	62	74
3. Unsuccessful sieges	27	90	117
4. Defensive battles	24	110	134
5. Successful sieges, terminated by assault	38	122	160

The general result for all these military operations in which 539,105 soldiers were engaged (the same men, be it understood, having fought in more than one battle or siege), is expressed by these figures :—

21 per 1000 killed.

90 per 1000 wounded.

In all 111 casualties.

We approximate to the truth if we state the immediate results of military operations at 2 per cent. killed, 9 per cent. wounded, and 11 per cent. total casualties.

Of course, all the figures I have given were very largely exceeded in individual instances. Thus, the offensive battle of New Orleans (which was an attack on earthworks mounted with cannon and defended by practised riflemen), cost us 317 per 1000 casualties; and Albuera (numbered among defensive battles), the still higher figure of 395. St. Sebastian was taken by assault, with a loss of 313 per 1000 *hors de combat;* and we were repulsed from Bergen-op-Zoom, after having 272 per 1000 killed or wounded.

It may be interesting to add that, in the unsuccessful assault on Sebastopol, Oct. 5th, 1854, we had 179 in the 1000 put *hors de combat.*

The figures I have just given show the immediate

results of military operations. But to understand the full effect of warlike conflicts we must add to the killed one eighth for the victims of severe injuries, or the operations they rendered necessary. With this correction, the figures will stand thus :—

	Per 1000.
Killed, or mortally wounded	32
Wounded	79
Total casualties	111

Having now spoken of the immediate and proximate results of military operations, I must next treat of the matter in which we are most directly interested, the relative mortality from injury and disease.

This is only to be ascertained for long periods of time, and from such returns as those of the Adjutant-General. Making use of these returns, Mr. Hodge has shown that the total annual casualties in action prior to 1812 did not exceed 4·38 per 1000, while the deaths from diseases amounted to 49·61, or very nearly 50 per 1000. So that the losses by sickness were eleven times as great as by all forms of mechanical injury. But subsequently to 1812, our losses by battle attained much higher figures, while those by sickness diminished. But of this more presently.

It may be worth while to observe in passing, that whereas in the six years ending 1808, our mortality through casualties in action was only 1·91, or less than 2 per 1000 of the deaths from all causes ; it rose to 7·30 or more than 7 per 1000 in the four years following 1808. In the first period, the deaths by casualties in action were in the proportion of about 1 to 20 of the deaths from all causes, while, in the second period of harder fighting the ratio became about 1 to 9.

I shall now make an attempt to give a more precise idea of the operations of war on land by selecting some

continuous record which shall be to the army what Trotter's General Abstract was to the navy. Need I say that I find what I want in Sir James Macgrigor's "Sketch of the Medical History of the British Armies in the Peninsula of Spain and Portugal," read to the Medico-chirurgical Society, June 20th, 1815, and published in an early volume of their transactions. Sir James, who had had large experience in many parts of the world, and had done good service in Egypt, after Corunna, and at Walcheren; of whom the Duke of Wellington, writing in July, 1814, says that he was "one of the most able, industrious, and successful public servants" he had "ever met with" (a truthful tribute which, with equal justice, Sir James was in a condition to pay to his noble chief, who thoroughly appreciated the services of our profession, and treated Sir James as Lord Howe treated Trotter, with full confidence and effective support) had the medical superintendence of the Peninsular armies from December, 1811, to June, 1814, a period of two years and a half, or thirty months.

In this period 346,108 cases of disease or wounds were treated in the hospitals, of which 232,553 were discharged cured; 4586 were invalided, or sent to England for the recovery of their health; and 18,513 died, including many hundreds who did not live one hour after they were first seen. The death-rate was 53 per 1000, which under the circumstances Sir James thought "*very small.*"

Sir James begins by dividing the thirty months into four periods of active campaigning, which consumed about twenty months out of the thirty.

1. The *first* was a winter and spring campaign of five months, from December, 1811, to April, 1812, with the capture of *Ciudad Rodrigo* and *Badajos* for its fruits; a period of hard work and great exposure, and, as the

result, 5000 wounded in hospitals: frost-bites, and tetanus, catarrh, cynanche, pneumonia, rheumatism, ague, continued fevers, and contagious typhus.

2. The *second* was a summer and autumn campaign of six months (from June to November, 1812), of which the great event was the victory of Salamanca. The health of the men was greatly tried by the retreat into Portugal, and alternate exposure to great heat, rain, and frost. And now dysentery, the scourge of armies, and hospital gangrene make their appearance, and there is a great mortality in the hospitals. Tetanus and continued fever are again mentioned, and remittent takes the place of ague. It is in the autumn months of September, October, and November, when febrile disorders are rife in Spain and Portugal, that dysentery and hospital gangrene show themselves.

3. The *third* of the four campaigns was like the preceding, a summer and autumn one (beginning with May, 1813). Its achievements were the victories of Vittoria and Pampeluna, the storming of St. Sebastian, and a footing in France. As a necessary consequence, we hear of many wounded, and of much tetanus; of dysentery, of hospital gangrene and contagious typhus, as bad as after the retreat from Corunna in 1809, of pneumonia, of agues, and remittent and continued fevers. There was great suffering from bad weather and transport by rough conveyances over bad roads, "but more from" the soldiers "own irregularities," for "the reports of the enormities and excesses committed by them were dreadful." But when the army halted, a strict discipline, a good supply of clothing and provisions, great vigilance of the medical staff, the establishment of regimental hospitals, and wholesome occupation for the soldiers, did much to restore the men to health. So that in August, "one of the most unhealthy months in the year in Spain," there was

an exemption from disease which Sir James attributes to "the healthy bracing air of the mountainous encampments at a distance from villages," the "moderate and wholesome labour" of the troops "in fortifying the passes," to the "abundance, and good quality of the provisions," "to the soldiers being excluded from the temptations to drunkenness and disorder," and "somewhat," as Sir James thought, to the exhilarating view of the plains of France, and the thoughts of the coming campaign.

4. The *fourth* and last of the Peninsular campaigns opened, after a severe and trying winter in February, 1814, and ended at Bordeaux in May, a period of four months. The severe weather brought back the catarrhs, rheumatism, and pneumonia of the first campaign; ague, continued fever, and contagious typhus maintain their ground; yellow fever claims attention; and dysentery, cholera, and diarrhœa are prevalent; but though there are again "many wounded" and much tetanus, hospital gangrene proves much less fatal. Some of the diseases which afflicted the army were much increased in those who were embarked for England in transports. We are told that "hospital gangrene spread; cases embarked as *synochus* landed as *typhus*, and some assumed the appearance of *typhus icterodes*." The four months of this spring campaign were well spent in forcing the French army across the Nivelle, the Nieve, and the Adour, and in winning the battles of Orthez and Toulouse. Sir James says of this concluding campaign that the climate and seasons were favourable, that the troops suffered little from disease, and that the hospitals contained few besides the wounded.

This interesting and instructive account of thirty months of campaigning concludes with some tabular returns, showing among other things, the deaths and causes of death in all the hospitals, general and regimental,

excluding French prisoners, but including *extra patients*. The facts are arranged in years, so that to make even a rough use of them it is necessary to multiply the deaths and causes of death in the six months of 1814 by two.

This is what I learn from these returns by classifying the causes of death under a few heads.

I take first in order wounds and their consequences, and find a total of 950 deaths in 1812, of 1638 in 1813, and at the rate of 1864 in 1814.

Taking next dysentery (the scourge of armies) and its allied diseases diarrhœa and cholera, I find the deaths from these causes, in 1812, 2427; in 1813, 1767; in 1814, at the rate of 1578.

Fever, in its several forms, accounts for 3167 deaths in 1812, for 2788 in 1813, and at the rate of 1484 in 1814.

By diseases of the lungs, of which pneumonia and phthisis occupy the first place, we lost 114 in 1812; 216 in 1813; and at the rate of 384 in 1814

The deaths from all causes were 7193 in 1812; 6866 in 1813, and at the rate of 5818 in 1814.

From these figures, taken one with another, I think we may infer that, in these three years, the losses by wounds and their consequences went on increasing, as did also diseases of the lungs; but that dysentery and fever, the two scourges of armies, inflicted upon us a rapidly decreasing rate of mortality.

If I correct these figures, as far as it is possible to do so, by taking into account the total strength of the Peninsular army in the month of January of each year, I obtain these results:—

	Per 1000.
Deaths by wounds and their consequences ...	19, 25 and 29
,, dysentery and the allied diseases ...	47, 27 ,, 23
,, fever...	62, 42 ,, 22
,, lung diseases	2, 3 ,, 6
,, all causes	141, 105 ,, 87

Sir James Macgrigor's paper abounds in interesting details and suggestive hints, and contains some brief and highly instructive numerical details.

Two facts of this order relating to recruits and old soldiers may well arrest our attention. In nine months (August, 1811, to May, 1812) the 7th regiment lost 246 men, the recruits at the rate 478 per 1000, the old soldiers of only 67 per 1000, a sevenfold loss on the part of the recruits. The 40th regiment in about the same time has 170 deaths, of which the recruits contribute at the rate of 231, the old soldiers at the rate of 59 per 1000, a fourfold loss on the part of the recruits.

Another fact mentioned by Sir James is well worth notice—namely, that regiments that had been at Walcheren suffered even more than recruits, and that the 91st Highlanders, which had suffered most of all, still retained a sallow and unhealthy look in January, 1814. This fine regiment, in the twenty months from October, 1812, to May, 1814, out of a total strength of 1703 (including 121 recruits), lost 220 men, and had fifty-six invalided; the deaths, therefore, being at the rate of 129 per 1000. But this high rate of mortality was far exceeded in the 1st battalion of the 1st regiment of the Guards. In the same period of twenty months it suffered the enormous loss of 674 men dead in hospital and had 280 invalided, out of a total (including 565 recruits) of 1965 men; being at the rate of 343 per 1000—considerably more than one-third in twenty months.

One other fact I must mention; and it is a fact repeated more than once. Sir James, speaking of the fatal fever which attacked the first division, but was confined almost entirely to the Guards, adds that the German regiments of that division were "among the most healthy corps of the army," as he had uniformly seen them to be "on every service, particularly at Walcheren." In another

place, he says, "The temperance, steadiness, and regular habits of the German legion kept them always in a state of health." And he adds, in a note, "The first German Hussars neither lost a man nor sent one to the general hospitals during the retreat from Burgos, nor till after the next campaign was opened, and we were advancing into France."

When I read this I must confess that I congratulate myself, as an Englishman, that hitherto it has been our good fortune to encounter as comrades, not as foes, these temperate, regular, steady, and brave men; and I cannot but think, that had the French nation borne in mind this formidable list of soldierly qualities, they would have hesitated to enter the field against the soldiers who, partly through the possession of these qualities, have inflicted upon it such great and irretrievable disasters.

We have heard much of late of military organization; let us not forget this lesson of temperance, steadiness, regular habits, and health as a natural consequence, when next we have occasion to lead our troops to battle. If we have not learnt it, and German troops, with these old soldierly qualities and the new organization to back them, shall chance to be our foes, not even the unsurpassed bravery of British soldiers can save us from defeat.

The campaigns in Portugal and Spain naturally claim the first place in the history of our twenty-two years of warfare, on account of their long duration, the momentous issue involved in them, and the signal triumph with which they were crowned. But the expedition to Egypt (especially if we consider it as the sequel of the victory of the Nile, and Sir Sydney Smith's gallant defence of Acre) though of short duration and subordinate importance, has peculiar attractions of its own. Fought in a land as remarkable for its ancient civilization and rare fertility, as for the many scourges to which it has always

been subject, it is hard to say whether it abounded most in the elements of the romantic and picturesque, in facts bearing on the defence of our Indian Empire, or in experiences affecting the solution of great sanitary questions. It is to this expedition that I now invite your attention, assisted by the histories of Wilson and Walsh, and the brief medical record of the same James Macgrigor to whom we have been indebted for so much information on the peninsular campaigns.

We made our attack on Egypt for the expulsion of the French with two bodies of troops, of which the one acted from the coast of the Mediterranean, the other from the direction of the Red Sea. To the former fell the honour of conquest, to the latter the credit of most effective, though somewhat tardy, co-operation.

By the 1st of January, 1801, the force which was to invade Egypt from the side of the Mediterranean had mustered in Marmorice Bay; and, after being exposed for two days and nights to "the most violent thunder and hail-storm ever remembered," set out on their perilous expedition on the 23rd February, and on the 2nd March the fleet of 175 sail anchored in Aboukir Bay, the men of war riding where the battle of the Nile had been fought. On the 8th of March, a military force, estimated by Sir Robert Wilson at 12,000 effective fighting men, was landed, and won the battle of Aboukir, at a cost of 666 men, killed, wounded, and missing. In the advance, which occupied the interval from the 13th to the 18th, and involved us in a series of sharp encounters, we sustained a further loss of 1154; and at the decisive battle of Alexandria, fought on the 21st, when Abercrombie was mortally wounded, 1334. From this date to the 1st of September, when the surrender of Alexandria crowned the labours of the expedition, our loss in killed and wounded reached the low figure of 147. So that, with a

total loss of 3301 men (505 killed, 2723 wounded, and 73 missing), out of a force estimated at 12,000 effectives, we succeeded, in the short space of less than six months, in destroying, taking prisoners, or compelling the surrender of 32,180 French troops, who, with a civil establishment of 768 souls, made up the total of the French that occupied Egypt. If we add the deaths from disease to the casualties from actual fighting, we have still a great result, achieved at a small cost of life.

The force which assailed Egypt from the direction of the Red Sea consisted of Europeans and native Indians, in nearly equal proportions. The European troops, collected from the garrison of the Cape and from the several Indian presidencies, had an effective strength of 3759. The natives, brought together from different parts of India, numbered 4127. The total force of 7886 was landed at Cossir Bay, in three divisions, on the 16th May, 1801, the 19th May, and 4th June respectively.

This expedition to Egypt, then, afforded a rare opportunity of noting the effect of climate on the health of troops. One body of Englishmen direct from home, another collected from India and the Cape, and natives from every part of India, were made to undergo the fatigues of military life in a climate contrasting strongly with their own—the Europeans from India, exposed to tropical heat in crossing the Desert; the Indians gradually transferred to the cold shores of the Mediterranean, and both brought face to face with the plague and the ophthalmia.

Let us see what instruction we can glean from the histories of Wilson and Walsh on the one hand, and from the Medical Sketches of Sir James Macgrigor on the other; the one, be it recollected, having reference mainly to the European force which landed with Abercrombie at Aboukir Bay; the other to the mixed force of

Europeans and native Indians that disembarked at Cossir.

The most definite, and therefore the most valuable, information to be drawn from the two military histories is to be found embodied in tables showing the state of the army of Egypt at different periods of its progress, first under Abercrombie, then under Hutchinson. There are four such tables available; and they all present us with figures, stated in detail, of the men who, at the several periods referred to, were fit for duty, or incapacitated by sickness, distinguishing these last as present and absent. I have submitted the facts recorded in the several tables to calculation, and will now briefly state the results :—

1. When the troops were mustered at Marmorice Bay, on the 21st February, 1801, they numbered 16,599 rank and file; of whom there were sick (present and absent), 1704.

2. On the 7th March, the eve of the landing at Aboukir, out of a total of 14,954 rank and file, there were 1654 sick (present and absent).

3. At the camp before Alexandria, March 30, nine days after the battle, out of a total of 15,463 rank and file, there were 4264 sick (present and absent).

4. At the same spot, on the 13th September, Hutchinson had under his command, 19,647 rank and file, of whom 4938 were sick.

It will be seen, then, that if we limit ourselves to the rank and file of the infantry in every case, we obtain as the result of somewhat less than seven months of active operations, a sick-list of 102 per 1000, at Marmorice Bay; increased to 110 per 1,000 prior to the landing at Aboukir; further augmented to 276 per 1000 after the battle of Aboukir, the onward disputed march to Alexandria, and the battle of Alexandria itself; and, finally falling to the lower figure of 251 per 1000 at the end of

the campaign, when part of the Indian force had joined and the fighting had ceased.

The tables in which these figures are embodied enable us to throw light upon a point I have not yet touched upon: I mean the relative liability to sickness of different branches of the service. These are the figures obtained from the "State" of the troops in the camp before Alexandria:—

	Per 1000.
Sick in the infantry	276
,, ,, artillery	178
,, ,, cavalry	107
,, ,, gunner drivers	183

These figures which, with the exception of the last, are obtained from a sufficient number of facts, are in keeping with calculations based on the other returns. So that we may take it as a rule that, in warfare, the cavalry suffer least from sickness, the infantry most, while the artillery occupy an intermediate position.

I may yet have to refer to Sir Robert Wilson's history for some illustrations of disease and its causes; but, meanwhile, I will present to you as condensed an account as I can of the diseases and mortality that befell the mixed contingent of European and Indian troops which landed at Cossir at the dates already given—an account furnished from the most trustworthy official sources, by James Macgrigor, A.M. (better known, in after times, as Sir James Macgrigor), "head of the medical department of the army from India," and "member of the Board of Health in Egypt."

As the Indian army arrived in Egypt too late "to share in any other dangers than those arising from the diseases of the country," we have here an account of the effects of war divested of the incident of fighting, but of warfare in the birthplace of plague and ophthalmia.

In studying the plague, the author had the advantage of referring to the experience of Dr. Buchan and Mr. Price; of whom the former had charge of the pest-house at Aboukir, and the latter possessed an unusual amount of learning, and both had experience of the disease in their own persons.

The army from India landed at Cossir, on the western coast of the Red Sea, and entered Egypt by the old commercial route over the desert of Thebes. All the troops were assembled there early in the month of June, 1801; and, having recovered from the diarrhœa caused by drinking water containing much sulphate of magnesia, and become accustomed to this new beverage, were "uncommonly healthy." This, their healthy condition, was in great measure due to the wise sanitary measures adopted during the long confinement of six months on board ship. All the men selected for the service were in a healthy state, the transports were large, lofty, and roomy, supplied with good water, stocked with fresh provisions and vegetables, rice, pickles, spices, and tea; with wine, fermented liquors, and every other comfort for the sick. Good regulations were established on board all the ships, and rigidly enforced. One ship (the *Minerva*) sailed from Bombay "much crowded," and in a three weeks' passage to Ceylon had much sickness and several deaths on board; but three ships having been substituted for one, not a man died in the *Minerva* during the three months' passage to Cossir.

In Sir Robert Wilson's account of the contingent from India we encounter a passage which shows that the old enemy of the soldier and sailor, the jail distemper, had not been conquered. He tells us that certain companies of the 61st regiment of Europeans were detained at the Cape, in consequence of the jail fever having broken out in the ships *Sheerness* and *Wilhelmina*, which

brought out the 68th regiment, composed chiefly of boys, of whom the distemper carried off a great number, being also fatal to many of the sailors. These ships were made so healthy by cleansing and fumigation that 900 soldiers, after being nearly sixteen weeks on board, arrived at Cossir without a single sick man.

Clothing of white cotton during the hot weather, warm clothing in the cold season, bathing enforced wherever practicable, the diet in the case of the European troops made to conform as much as possible to that of the Hindoos, light Greek wines in the warm season and spirits in the cold, and for the native troops (whose prejudices were happily overcome) a portion of animal food and wine during the cold weather; these were the appliances with which the men were furnished whose first duty it was to cross a desert amid intense heat, hot suffocating winds, and storms of dust. "The fatigue on the march has, perhaps, never been exceeded in any army," and yet they reached the banks of the Nile, having had only some diarrhœa, and a few cases of ophthalmia and nyctalopia. During the greater part of July the army encamped on the banks of the Nile; but at the end of the month were embarked in boats, and by the 12th of August, after a navigation of nearly 400 miles, they arrived at Ghiza. During this voyage several cases of inflammation of the liver and of the lungs, of dysentery, fever, and ophthalmia, occurred, but mostly recovered on the passage; and the troops landed with a few cases only of slight fever. And now the soldiers began to be very sickly. In the first week, from a twelfth to a tenth of the force were in hospital; in three weeks the sick exceeded a thousand; and by the end of the month twelve hundred were embarked at Rosetta. The prevailing disease was a fever lasting two, three, or at most, five days, and rarely fatal. But there were many cases of ophthalmia, and

some of hepatitis and dysentery. On the 14th September, the first case of plague was recognised, and others soon followed. From this time the disease continued to show itself, in spite of very efficient measures of isolation and purification, till in January of the year following the number of attacks reached 72. In February it fell to 21, rose in March to 46, and in April again fell to 26. Part of the army marched to Alexandria in December, 1801, and all, with unimportant exceptions, were there in January, 1802. In May, they were on their return, crossing the Desert of Suez; and early in June, embarked for India, with the exception of one regiment, in which the plague still prevailed. Among the troops that embarked there was "hardly a sick man;" and when the one regiment that remained behind was inspected, prior to its embarkation, there were only four sick of colds. All the troops arrived safe at their several destinations.

It will be interesting to inquire at what cost in sickness and loss of life this expedition to the classic land of plague and ophthalmia was carried out. If we take the 1200 sick to which allusion has just been made as the maximum of sickness, we have a sick-rate of 152 per 1000; and if we sum up the figures in a table given of the deaths, and causes of death, in the Indian army, from the time of embarkation for Egypt to their re-arrival in India, we have a death-rate for the European troops of 82 per 1000, and for the native troops of 95 per 1000. But as the number invalided among the former amounted to 31 per 1000, and among the latter to only 10 per 1000, it is probable that the final death-rate did not differ materially in the two bodies of troops.

But the causes of death were very differently distributed among the two. For while the plague killed only 10 per 1000 of the Europeans, and fever 5, the first destroyed 31, and the second 22, among the native Indians. But,

on the other hand, while 17 per 1000 of Europeans died of liver-disease, and 39 per 1000 of dysentery, the deaths from the same causes among the Indians were 3 and 11 per 1000 respectively. Under the head of casualties and diseases unknown, there is an entry of 11 per 1000 for Europeans, and 22 per 1000 for natives.

It is true that the cases of Europeans and natives are not strictly comparable, because the average time that the former were on service was somewhat more than nine months, while it was nineteen months in the case of the natives. And if we reduce the figures in each case to the common standard of a year, we obtain for the European troops a death-rate of 109 per annum; for the natives the much lower rate of 60. If we deal in the same way with the causes of death, we find that while the plague destroyed our European troops at the rate of 13 per 1000 per annum, it killed 20 per 1000 of the natives; while fever proved fatal to 7 of the one and 14 of the other. On the other hand, diseases of the liver were the cause of death in 23 Europeans per 1000, and only 2 natives; and dysentery in 52 per 1000 of the one and 7 of the other. The mortality from casualties and diseases unknown was nearly equally divided between the two classes of troops.

If, now, we take into account that the European troops were invalided at the rate of 41 per 1000 per annum, but the natives at the much lower rate of 6, it must be obvious with what advantage and economy of life native troops may be employed in such a country as Egypt, provided their fighting qualities are up to the required standard.

Let us now see what can be learnt respecting the plague from Macgrigor's "Medical Sketches," over and above what Dr. Hodges taught us about it as it occurred in London in 1665.

Let us take the symptoms first. Hodges knew that

the fever of the plague assumed different types. In some patients it was continued, in others remittent, and in others, again, intermittent. Macgrigor was cognizant of this fact, which, however, struck him as a new feature in the history of the disease. In the cold season the fever was inflammatory, it was typhoid in patients brought out of crowded hospitals, of a mild form when it was about to disappear for the season. In some exceptional cases there was no fever.

Delirium was as common in Egypt as it had been in London; and tremors of the arms are mentioned as a most characteristic symptom.

Buboes were very general, but not universal, and they often showed themselves in from four to six hours after the first appearance of indisposition.

Most of the complications witnessed in Egypt were those which Hodges saw in London. There were distressing bilious vomiting and obstinate costiveness, diarrhœa and dysentery, pneumonia and pleurisy, and comatose symptoms, sometimes from the first.

Sudden deaths were as common in Egypt as they had been in London. They often occurred most unexpectedly during convalescence; and there were some in whom the least change of posture proved fatal.

Macgrigor had as little doubt that plague was contagious as Hodges had; but there was among the staff of doctors and surgeons one who seems to have sacrificed his life to his scepticism. I say *seems*, because he was exposed to the same danger as his twelve colleagues, of whom six caught the disease, and four died; but, as he fell ill soon after inoculation, it is likely that that was in him the true cause. It was on the evening of the 2nd January that he rubbed bubonic matter into his left thigh, and on the following day inserted it into a wound in the right fore-arm. On the evening of the 6th,

he had shiverings and febrile symptoms, which he took for ague; on the morning of the 7th he was better, but in the afternoon of the same day, after half an hour of rigors, followed by a profuse sweat, pain in the head, tremors of the arms, and other characteristic symptoms showed themselves, and on the afternoon of the 9th he died delirious.

The latent period, like the duration of the malady, was very various. Cases are given of ten and seventeen days.

Concerning the treatment we learn that Dr. Whyte used the lancet very freely, but that every one of his patients died; that Macgrigor himself had little to boast of in his treatment of some cases; that Mr. Price thought well of citric acid, with which, and baths of strong vinegar, he thought he had cured some Arabs; but that the place of honour belonged to mercury, given so as to affect the gums. Macgrigor, judging by reports of cases which he inserts among his sketches, had some reason for looking upon this form of treatment as holding out "a prospect of success the most encouraging." But, in addition to the difficulty we must always have in judging of the relative success of treatment in all epidemics, through the varying severity which marks their onset, meridian, and decline, we cannot resist the suspicion that the susceptibility to the action of mercury in the cases in which it shows itself, marks those milder and more tractable cases that would have recovered had no mercurial preparation been administered.

But if we must needs speak doubtfully about the cure of the plague, we need not hesitate to give credit to the authorities for the preventive measures which they brought to bear upon it. "If," says Macgrigor, "in the treatment of the disease, we were not successful, we assuredly were completely so in the prevention. At

length this became so generally known, that we no longer heard the distressing accounts of despondence and despair among the natives." He is speaking of the native troops from India who began by abandoning themselves to despair, but ended by furnishing volunteers for duty in the pest-houses.

The preventive measures adopted with such success are embodied in General Baird's order to the army, and it may be well that I should briefly state what those measures were.

1. To every hospital, an observation-room, or a tent, was attached, and to it every case with febrile symptoms was sent, as soon as they were discovered, to be there most strictly watched by the surgeon.

2. On any symptoms of the plague appearing, the case was instantly sent to the pest-house from this room or tent, accompanied by the surgeon who had attended it, that he might give to the medical attendant at the pest-house an account of the treatment previously adopted. If there was any doubt about the case, the patient was placed in the observation-room of the pest-house; and if the disease did not turn out to be plague, he was sent to the quarantine.

3. Every corps and department was minutely inspected by the surgeon twice a week; and every person having the least appearance of ill-health was sent to the hospital.

4. Every corps or hospital where the case of plague occurred, was put into quarantine, and such corps or hospital was inspected by the surgeon, at least two or three times a day, and every case with suspicious symptoms was ordered to the observation-room.

5. In suspected corps, bathing was enforced frequently and at stated periods, and their clothing and bedding were frequently washed and baked. To all the hospitals ovens and smoking-rooms were attached.

6. Quarters, hospitals, and camping grounds were frequently changed.

7. Nitrous fumigation was constantly practised. Lamps used for this purpose were kept constantly burning in the observation-rooms, and in those from which the plague cases had come. Vessels containing materials for the fumigation were also placed under the beds, and in the corners of the rooms. When the stock of nitre was exhausted, marine salt was substituted for it.

By means such as these the plague, which was deemed to have been very prevalent in the season that ended June, 1801 (the period from November or December of one year, to June of the following, being the recognised cycle of the disease), was so held in check, that it proved fatal to only 38 European, and 127 Indian soldiers.

That the season of 1801 was a bad one for the plague, may be inferred from certain statements to be found in Sir Robert Wilson's history. The Mamelukes, he tells us, had suffered severely, sixty thousand people having died of the plague in Upper Egypt, while forty thousand were attacked by it in Cairo; and he learnt from an intercepted letter written by General Belliard, that, in six days, one hundred and fifty soldiers had died of the plague in Cairo, and his wife and three servants in forty-eight hours. We also learn that the disease raged so violently at El Arish, as to reduce the native Egyptian garrison of 4000 to 1500 in less than a month.

Of the mortality inflicted by the plague and by other diseases on the British army that landed at Aboukir, we have no accounts in the works of Wilson and Walsh; but there are many allusions to the excessive prevalence of sickness among the troops.

On one point of special interest in reference to the plague, and the causes which produce and promote it,

we have less information than we should expect in Macgrigor's "Medical Sketches," and what little there is is to be found in a single passage to the effect that "the structure of their houses, and the plans of their streets are calculated for the production of disease, and the preservation and concentration of contagion."

But Sir Robert Wilson happily supplies any possible shortcoming in this respect. He tells us that, "a Turkish market-place is sufficient to generate a plague;" that "it is never cleaned;" that one layer of blood lies upon another; that the scene is indescribable.

In speaking of the city of Rosetta, he says: "the streets are not more than two yards wide," that they are infested with "filth, mosquitoes of the most dreadful sort, vermin of every kind," with "stench intolerable," and "houses almost uninhabitable;" that uncleanliness so prevailed in the very baths, and the passages leading to them, as to make "the air so tainted and oppressive," that English visitors turned back in disgust. The French, however, seem to have had stronger stomachs; for Sir Robert styles this very Rosetta, "Savary's Garden of Eden." The inhabitants of this charming spot seem to have been quite in keeping with the place itself. The quantity of blind was prodigious, nearly every fifth inhabitant had lost his sight, or had some humour in the eyes; erysipelas, dropsy, leprosy, elephantiasis, contortions, and *lusus naturæ* of every sort abounded, and the women were so ugly that the writer deemed it fortunate for Europeans that they concealed their faces by black cloth veils with two holes only for the eyes.

Of the misery of an Egyptian village Sir Robert conveys to us a very lively idea by describing an Irish hut as a palace compared to the sties of which it is made up. "Each habitation is built of mud, even the roof, and resembles in shape an oven." It consists of "only one

apartment, generally of about ten feet square. The door does not admit of a man entering upright; but as the bottom is dug out about two feet, when in the room an erect posture is possible." "Here a whole family eat and sleep, without any consideration of decency or cleanliness." These villages are not improved by being surrounded with high mud walls.

Lastly, Sir Robert gives an account of the state of the camp of the army of the Grand Vizier, at Balbeis, which is in perfect keeping with what I have just told you of the condition of markets, houses, villages, and towns. It was a "disgusting chaos," with dirt and filth enough "to generate the plague, and every pestilential disease." For one example of perverse and fantastic nastiness, reference must be made to a note at p. 116 of Sir Robert's history.

Such then, so late as the first year of this century, was the condition of the country and people from which the plague was never absent; and not very unlike it, not very much raised above it, was the state of the plague-haunted metropolis of England when the great fire destroyed it.*

There is much more connected with this double expedition to Egypt which, if time permitted, I should be glad to notice, and especially the "resolution, patience, and spirit," with which our soldiers bore all the exposures of a most trying climate. This may have arisen in part from the fact that "frequently they were obliged to drink only water," that, "never, indeed, had an army before been so abstemious, and consequently so well conducted."

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* In speaking of the plague in my fourth Lecture—See "Public Health," Part I., p. 83—and again in this, I have not yet noticed, as I ought to have done, the valuable information relating to the plague to be found in that section of John Howard's works which treats of Lazarettos.

With these suggestive words I pass from this necessarily brief record of an admirably managed and most successful campaign to that painfully instructive contrast, the fatal expedition to Walcheren in 1809.

This expedition had for its objects the capture or destruction of the enemy's ships building at Antwerp and Flushing, or afloat in the Scheldt, the destruction of the arsenals and dockyards at Antwerp, Terneuse, and Flushing, the reduction of the island of Walcheren, and, if possible, the rendering the Scheldt no longer navigable for ships of war.

With these important objects in view, a mixed armament of soldiers and sailors to the number of about 70,000, of which the military force alone numbered about 42,000 (the largest expedition, I believe, that ever left our shores), anchored near the coast of Walcheren on the 28th and 29th of July. On the 30th Sir Eyre Coote landed with 12,000 men, other landings soon followed; on the 13th August Flushing was bombarded, and on the 15th it capitulated.

The bombardment had the effect of seriously injuring the buildings in which our troops had to be accommodated, so that some of them lay in cold damp churches, without beds, with their great coats for covering, and their knapsacks for pillows, while the hospitals were warehouses into which light and air were admitted only through iron gratings.

On the 20th August sickness began to show itself among the troops in South Beveland, the sick numbering already 1564. On the 23rd the sickness greatly increased, and augmented so rapidly that by the 26th of the month no less than 5000 rank and file were ill.

On the 27th, a council of war decided that the siege of Antwerp was impracticable; so that thus early in the day sickness had frustrated the ultimate and chief object

of the expedition. By the 28th of the month many officers had been seized with fever. The report for the 31st was "sickness still increased," and the officers of the medical staff suffering much. On the 1st of September, in spite of the constant removal of troops, sick and sound, the sick list numbered 5000, on the 3rd, 8194, and on the 7th, 10,908. On the 10th, 7396 sick still remained in Walcheren. From this date to the 23rd December, when the evacuation of the island of Walcheren was completed, the history is one of sickness and of that only.

At this point, which we have reached under the guidance of Mr. Marshall,* I turn for a summary of results to one of Mr. Hodge's tables, compiled with his usual care and minuteness. It appears that, on the average of the ten weeks (from September 19th to November 28th), the officers suffered from sickness at the rate of 166 per 1000 of main strength, and the rank and file of 470 per 1000; that the sickness of the officers attained its maximum of 307 per 1000 as early as the week ending the 17th September, and fell progressively to a mimimum of 78 per 1000 on that ending November 28th, but that the sickness of the men was at its maximum of 587 per 1000 in the week ending October 8th, and fell to 155 per 1000 in that ending November 21st.

If from this sad account of sickness we turn to the mortality, and to that column which shows the equivalent annual destruction of life, we find the officers perishing at the mean rate of 181 per 1000 (the maximum occurring in the week ending September 17th), while the rank and

* "Contributions to Statistics of Sickness and Mortality which occurred among the Troops employed in the Expedition to the Scheldt in the Year 1809." By Henry Marshall, Deputy Inspector-General of Army Hospitals (Edinburgh Medical and Surgical Journal, No. 133).

file died at the astounding rate of 640 per 1000 on the average (the maximum of 910 per 1000 being recorded for the week ending September 24th). The lowest rate for the officers was 88 per 1000, for the men 235.

The average of 640 per 1000 has perhaps never been exceeded in warfare ; for the rate during the worst seven months of the Crimean campaign is stated by Mr. Hodge at 600.

We obtain a very vivid idea of the sickness and mortality to which our troops were subject in this ill-fated expedition, from a return of the sick admitted into the general and regimental hospitals in the eastern district of England, from corps employed in the Scheldt. The sick numbered 17,536, of whom 914 died ; the death-rate being a maximum of 1 in 5 among the worst cases, a minimum of 1 in 30 among the mildest, an average of 1 in 19.

From a return, laid before the House of Lords, it appears that between January 1st and June 1st, 1810, there were admitted into hospital, from the corps which served in Walcheren, 36,000 patients ; and from another return submitted to Parliament, 10,000 men were sick, and 2000 died during the time that the Ministry were debating whether Walcheren should, or should not, be retained. The total loss of life has been set down at 8000, and the cost in money at twenty millions, or nearly one million in taxes for every year of the war. Need I tell you that the Expedition landed the troops in a swamp, where the inhabitants were known to be very liable to fever, to have an unhealthy aspect, and to suffer a rate of mortality in excess of that prevailing in the marshy parts of some our English counties ; need I add that the effect of the climate on the health of strangers was known to be most disastrous ; that a Scotch regiment in the Dutch service had been known to bury their whole num-

bers at Sluys, in Dutch Flanders, in three years; that the same rate of mortality prevailed among the French, and among a native Dutch regiment, of whom we found a remnant of 85 men, the survivors of 800 landed in Walcheren only three years before? It was, then, to this swamp, notorious for the unhealthiness of the natives, and a destruction of life among foreign soldiers at the rate of a whole regiment in three years, that we sent out our brave men to perish. Can we wonder that Napoleon was rejoiced to see his redoubtable foes, always so hard to conquer in open fight, "packed in the morasses of Zealand;" or that the French "crowed over the expedition with the force of reason, the bitterness of sarcasm, and the playfulness of ridicule?"

The account I have just given you of the successful expedition to Egypt will serve to suggest at least this reflection, that it is better far to expose an army to the plague, which, being contagious, may be kept in check by obvious methods of precaution, than to land it in a swamp where the air is filled with a poison against which there is no protection, and no safety but in flight.

LECTURE XII.

SANITARY PROGRESS.

HAVING in my last two lectures treated of the losses inflicted by disease, and the disabilities entailed by sickness, first on our navy and then on our army; I proceed to compare, in these respects, the one service with the other, speaking first of deaths by disease compared with casualties in fighting, and then of sickness taken by itself.

Let us begin by supposing 1000 sailors to have been engaged in the various operations of naval warfare as carried on from 1793 to 1815: they would have had 20 killed and 60 wounded, or 80 casualties in all. But if we substitute soldiers for sailors, and suppose them also to have been employed in every kind of military contest, the 1000 soldiers would have sustained a loss of 21 killed in lieu of 20, and 90 wounded in lieu of 60, making in all 111 casualties in place of 80.

If we class the results of actual fighting under the three heads of mortally wounded, not mortally wounded, and total casualties, we get for the navy the figures, 28, 52, and 80; and for the army 32, 79, and 111. But, as already stated, the actions between single ships, which have no parallel in any military operations, are exceptionally destructive. We ought, therefore, to compare the actions between fleets, or squadrons, on the one hand, with land battles on the other; and naval attacks

on land defences with their nearest analogues, siege operations.

The first of these comparisons yields the following results:—Our leading naval engagements, in which an aggregate of 92,180 sailors were engaged, caused a loss in killed of 17 per 1000, in wounded of 51 per 1000; or 68 per 1000 of total casualties. Our principal land battles, fought by an aggregate of 402,405 soldiers, issued in a loss per 1000 of 19 killed (in lieu of 17) and 88 wounded (in lieu of 51); giving, as total casualties, 107 per 1000 (in lieu of 68).

The second comparison, or that between naval attacks on land defences and military sieges (21,651 sailors being engaged and 137,300 soldiers), yields the following figures:—Naval attacks, 26 per 1000 killed, and 57 wounded, total casualties 83 per 1000. Military siege operations, killed 30 (in lieu of 26), wounded 94 (in lieu of 57), total casualties, 124 (in lieu of 83).

These, be it recollected, are average results, applicable to a succession of varied operations by land and sea, but certain to be very largely departed from, in the directions both of excess and defect, if we limit our comparisons to single analogous operations. If, for instance, we were to compare the naval engagement at Genoa fought by Lord Hotham with 8810 sailors, with Albuera, which Beresford fought and barely won with 9000 soldiers (the numbers being, therefore, nearly equal) we should find that, while we lost 71 sailors, and had 266 wounded, or a total of 337, we lost no less than 882 soldiers, and had 2672 wounded, or a total of 3554. So that the casualties in the naval engagement were at the rate of 38 per 1000, while those in the land battle amounted to no less than 395 per 1000, or more than ten times as many.

On the other hand, if we compare the great victory of Trafalgar with the victorious military operations of

Corunna, and Ciudad Rodrigo (the numbers of men engaged being respectively 16,826, 16,700, and 16,600), the total casualties are found to have been 100 per 1000, or exactly 10 per cent., at Trafalgar; 47 at Corunna; and 60 at Ciudad Rodrigo. In this case, though the two military operations conform to the rule, inasmuch as the siege is more destructive than the battle, the rule is transgressed which makes the naval engagement less destructive to life than the military.

I have yet to compare the deaths from disease as they occur in the navy and army respectively. In other words, I have to bring together and place side by side the figures referring to the two services which I have already submitted to you. In the navy, as I have stated, the deaths by disease are nearly seven times as numerous as those that result from actual fighting. But in the army, the mortality from disease is no less than eleven times as great as that inflicted by fighting.

Disease then, as a cause of death, levied a higher toll on the soldier than on the sailor, in the proportion of 11 to 7; levied it, that is to say, during part of the long war that terminated in 1815. A larger and longer experience might, of course, alter these ratios; but it would, I believe, remain a general truth that the naval service proves less destructive to life than the military.

The loss sustained by officers and men respectively, in battle and by disease, is a point of some interest. In the navy, in consequence of a want of information respecting the relative numbers of officers and men exposed to risk, Mr. Hodge was unable to ascertain the true figures. But with the army he was more successful. He found that during the whole period of the war, from 1793 to 1815, the officers died at the rate of 7·06 per 1000, the non-commissioned officers and rank and file, of 6·60; while the annual ratios of casualties to the 1000 were

30·19 and 22·88. This excess of injuries in battle sustained by the officer is, however, more than compensated by his better accommodation in quarters and in hospital, and his less liability to attacks of sickness.

I cannot show this comparative immunity of the officer from sickness, and mortality arising out of it, better than by taking that one among the weekly returns of the sick and dead in the fatal expedition to Walcheren, which shows the largest mortality among the officers. It is the week ending September 17th. The sickness among the rank and file was at the rate of 468 per 1000; the deaths 16, or 1 in 29 of the sick; while among the officers the sick numbered only 307 in the 1000, among whom 9, or 1 in 34, died.

Of sickness, as a means of diminishing the number of fighting men in navy and army respectively, I have no figures to bring forward which you would accept as showing the relative liability to sickness of the two services. Trotter's census of April, 1794, to which I have already referred, shows for Lord Howe's fleet a ratio of 33 per 1000, and this must be considered a very favourable ratio, seeing that the daily sick-rate for the home station, in the year of peace, 1868, was nearly 38 per 1000. In the whole army, for the same year, 1868, the "constantly non-effective from sickness," if taken to mean the same thing as the "daily sick-rate" of the navy, was 47 per 1000, while the figure for the whole navy was 48. The death-rates were, for the navy, 89 per 10,000, for the army, 148 per 10,000.

Against the 33 per 1000 of sick in Lord Howe's fleet, in April, 1794, I have no army return to adduce which shows any approach to these favourable figures.

The most favourable return of sickness I have come across is to be found in Walsh's "Journal of the late Campaign in Egypt." The troops mustered in Marmorice

Bay had 84 in the 1000 sick, but the ratio rose to 103 and 110 per 1000 after the landing in Egypt, and, in the army under the command of Hutchinson, which finished the work that Abercromby began so well, the said army having advanced into Egypt, the sick-rate reached the high figure of 261 per 1000.

The lowest figure for our troops in the Peninsula was 94 per 1000 on the 22nd April, 1809. It was 97 on the 1st of May. It reached its maximum in October, 1811, when it was 330 in the 1000. In the Walcheren expedition the sick-rate ranged from 155 per 1000, for the week ending November 21st, to 587 per 1000, for the week ending October 8th. The average was no less than 470 per 1000, that of the Peninsula being 209, and of Egypt 182. I have referred to Sir James Macgrigor's "Medical Sketches of the Expedition to Egypt from India," in the hope of finding some returns of sickness in a body of troops, the lesser half of which consisted of Europeans serving at the Cape and in other colonies, and the greater half of natives of India; but I have been disappointed. This little work, however, contains some details of mortality chiefly caused by dysentery, liver-disease, plague, and fever; and to these I referred in my last lecture. I may here repeat the statement that the mortality among our European troops was at the rate of 82 per 1000 per annum, and among the natives of India, 95 per 1000; the death-rate in the Duke of Wellington's Peninsular army, during forty-one months, having been at the higher figure of 109 per 1000 per annum.

If we would know what sickness of the more severe order may do to thin an army, we must go to the records of individual regiments, such as the first battalion of the 1st regiment of the Guards, which served first at Walcheren, then in the Peninsula. From facts stated by Sir James Macgrigor, it appears that that fine regiment

suffered a loss, in twenty months, equivalent to 206 per 1000. But this mortality of one-fifth is cast into the shade by a calculation of Mr. Hodge, which assigns to our ill-fated army in the Crimea a loss, in seven months, at the rate of 600 per 1000 per annum—a loss, to find a parallel for which we must look to the experience of our armies under a tropical sun, or in the West Indies, to which, as Robert Jackson tells us, several newly recruited corps were sent out during the war that preceded that of the French Revolution, with this result, "that though not a man died by the sword, yet, in the short space of two years, there scarcely was a soldier left." This most painful statement, respecting the Crimean War, forms a fitting climax to the little that I am able to say on the subject of sickness as a means of diminishing the number of our fighting men—of impairing the efficiency of our fleets and armies.

I now pass on to that topic which I reserved for this, my last lecture: the means by which the loss of life that war entails, whether by land or sea, in actual fighting, or by disease, has been lessened; taking note especially of those inventions and discoveries for which society is indebted to our own profession. To exhaust this branch of my subject, a short course of lectures would be necessary; but I hope to give, in this one lecture, an outline of it which others, with the advantage of fuller technical knowledge, may be tempted to fill up.

If I were writing a complete treatise on the alleviations of which the state of war has proved to be susceptible, I should be disposed to divide it into several heads, among which I may indicate the following:—

1. That slow and insensible improvement in the thoughts and tempers of mankind, which has led to the abandonment of such wars of extermination as were once waged under the pretence of divine authority, or

the cloak of religious zeal; and the condemnation, at least, of those wars of conquest that were prompted by personal craving for territory.

2. That other improvement of the same order which has substituted captivity for slavery, and exchange of prisoners for their murder in cold blood; and, by so doing, has led men to fight less fiercely, and to yield when obviously defeated.

3. All those inventions that have issued in the substitution of missiles for hand to hand combat, and especially the invention of gunpowder, which by shrouding fleets and armies in a canopy of smoke, has gone far, if not to abolish, at least to diminish angry and destructive personal conflicts.

4. The progressive improvement in the health and physical condition of the communities from among whom soldiers and sailors have been recruited.

5. And lastly: discoveries and inventions directly applicable to the wounded and the sick.

Of these causes of amelioration in the state of warfare, as destructive of life, the fourth and fifth properly belong to the subject of these lectures. I shall, therefore, treat of them in their order, beginning with the improved health of the communities which feed armies and fleets with their living armaments—with men and with horses; for what is true of soldiers and sailors will hold good, in its degree, of the animals that play so important a part in military operations.

In treating the first of these two topics—the ameliorations following on the improved health of the communities from which the supply of fighting men is drawn, I shall content myself with our experience here in England, taking the year 1815 as the limit of my inquiry; and as my starting point, the middle of the fourteenth century: or the year 1346, when Edward III. invaded France,

and won the great battle of Crecy, besieging and taking Calais (in the year following). This battle of Crecy, and this date (1346) are points of special interest; for it is alleged that then artillery was used for the first time in the field; and two years later (in 1348), the terrible Black Death invaded us, inflicting the greatest loss of life which we have ever suffered. This terrible pestilence, too, furnished us within the limits of these islands, with one of our earliest lessons on the contingent miseries entailed by war. The Scots are stated to have been free from the Black Death till they made an irruption into English territory. They were unsuccessful, and carried back with them into their own country defeat and the plague. Their army was nearly destroyed by the sword and the pestilence together, and the civil population was infected by those who escaped. At so heavy and so unexpected a cost have nations purchased the luxury of invading the territories of their neighbours.

I need not tell you that this is no solitary instance of the mischievous agency of armies in conveying pestilences from place to place, and from country to country. The Sweating Sickness of 1485, appears to have originated with the army of freebooters and mercenaries who fought at Bosworth Field; the Petechial fever, five years later, decimated the Spanish army of Ferdinand the Catholic; the fourth attack of Sweating Sickness, in 1528, coincided in point of time with great military operations in Italy, where the Petechial fever raged among the French and their allies at the disastrous siege of Naples; and it was this fever that attacked the Imperial troops in 1547, and the Hungarians in 1566. Indeed, throughout this 16th century, the gathering and disbanding of mercenary troops was the acknowledged means of generating and dispersing more than one fatal pestilence in England and throughout the continent of Europe; and it is most

probable that the 700 deaths that took place in the squadron of Sir Francis Drake, in 1585, and which were ascribed for the most part to the fevers known as Calentures, were instances of disease carried by landsmen to sailors at sea. We have an undoubted instance of such infection of fleet by fleet, in the fever which the victors of the 1st of June took from the crews of the captured French vessels, as described at length in my tenth lecture. Since that fatal 16th century, the production and spread of disease by means of masses of armed men has come to be an event less and less common; and this great sanitary improvement certainly kept pace with the growing immunity from the worst forms of pestilence among the nations from whom the fighting men were drawn.

Accordingly, the Plague, which paid us its first registered visit in 1593, and its last in 1665, is traced to the operations of commerce, not to the movements of armies.

The Plague, which gradually died out and disappeared from the Bills of Mortality in the few years following the great fire of London, was the last of that series of imported pestilences which began with the Black Death (doubtless an aggravated and modified form of the Oriental Plague); and its final disappearance marks a point of time in our sanitary history when the manners and habits of the people had so far improved as no longer to offer a welcome to these dangerous visitors. In this immunity of our civil population the army and navy certainly participated, as they had previously shared its dangers.

What the habits and manners of our ancestors were in the times of our destructive imported pestilences we all know. Of the places in which men lived and congregated it is scarcely an exaggeration to say that their houses were sties and their towns farm-yards; and that

their clothes and persons, and manners and customs, were in keeping with the state of the places they lived in. The letters of Erasmus,* written in the days of Cardinal Wolsey, in harmony, as they are, with earlier and later accounts, fully justify these statements; and the slow and gradual way in which our ancestors emancipated themselves from this thraldom of filth is quite faithfully set forth in the witty words of Sydney Smith, who asserts that "all degrees of nations begin with living in pigsties;" that "the king or the priest first gets out of them, then the noble, then the pauper, in proportion as each class becomes more and more opulent;" that "better tastes arise from better circumstances, the luxury of one period being the wretchedness and poverty of another."

And this principle of gradual extension of physical improvements from class to class doubtless prevailed in respect of the introduction and diffusion of all those aids to health which from time to time agriculture, manufactures, and commerce have bestowed upon us. It was little by little that the salt meats which Erasmus spoke of as constituting so large a part of our English dietary got replaced by fresh meat; that wheaten bread took the place of rye; that vegetables became common articles of food; that the culture of the potato spread from country to country and place to place; that tobacco, in spite of obvious objections to its use, came to replace, to some extent at least, the strong malt liquors and ardent spirits in which our ancestors so freely indulged; and that tea, coffee, and chocolate entered into a still more effective and most wholesome competition with those prolific sources of disease. What is true of shelter and food holds good also of clothing and personal cleanliness. It was by

* See "Public Health," Part I., Lecture III., p. 71.

slow degrees that articles of linen and cotton came into use as clothing worn next the skin, easily cleansed and readily changed: and that soap, soda, and potash found their way into every household as abstergents. By similar slow degrees must such valuable remedies as lemon-juice, bark, opium, mercury, antimony, and arsenic have had their virtues recognised, and so come into general use. The seventeenth century witnessed, I need scarcely remind you, the introduction and extension among the people, of several of these aids to health and remedies against disease; and it was also the epoch of at least one great reform in the treatment of the sick, especially of that greatest of all innovations, the substitution of the *cool regimen* for the *hot*.

Such wholesome influences as these, constantly at work during the seventeenth century, spreading from class to class, from place to place, from person to person, cannot but have had a marked effect on the health of the community at large, and of the soldiers and sailors taken from among them; so that the dawn of the eighteenth century must have witnessed a condition of things greatly in advance of that which prevailed at any previous period of our history. Perhaps the *seventeenth* century might be singled out as the age of unconscious and incidental sanitary improvements, and the *eighteenth* of conscious and sustained efforts in the same direction. We now know how much need there was of such efforts, as well as the direct bearing which those efforts had on the health of our soldiers and sailors, the efficiency of our armies and fleets. So that the period of the great war which occupied the last years of the eighteenth and the first of the nineteenth century may claim to be the most suitable of all epochs for the treatment of war in its sanitary aspects.

The conscious and sustained efforts of which I am speak-

ing were carried on chiefly by Captain Cook, John Howard, and Edward Jenner; to which names I may add those of Sir George Baker, who found out the true cause of the Colic; of Sutton and others who worked at the practical matter of ventilation; of Brocklesby, who made some capital experiments on extemporized military hospitals; of Lind, Blane, and Trotter who threw so much light on the diseases of seamen; of Pringle, Jackson, Fellowes, and others, who conferred similar benefits on soldiers. Of this class of efforts and inquiries, the one that requires special notice in this place, as having first effected an immense improvement in the health of our civil population, and then, both indirectly and directly, in that of our soldiers and sailors, is the one which John Howard undertook, and carried to so successful an issue in the prisons of England. There are few things in history more surprising than the fact that our prisons should have continued in the state in which Howard found them to so late a date as 1773, when he was happily appointed sheriff of Bedford.* I have already, in the lectures to which I have referred, treated this subject of Howard's labours, discoveries, and reforms so fully that I must here content myself with stating that the prisons of England were a perennial source of that old pestilence, the Jail-distemper, which had so often invaded our courts of law, at the Black Assizes; which was continually infecting our civil population by means of discharged debtors and criminals, and through the recruits taken from the same degraded classes, our armies and our fleets. It is, therefore, simply impossible to estimate the value of this great work of Howard's, the cleansing and reforming of the prisons of England. The nearly con-

* See "Public Health," Part I., Lecture I., p. 23, and Lecture VII., *passim.*

temporary labours of Captain Cook had more direct and exclusive bearing on the health of seamen, whether engaged in commerce or war; and the great discovery of Jenner, somewhat later in point of time, so far resembled Howard's work that it affected our soldiers and sailors both indirectly, through the people at large, and by direct application to themselves. Of Sir George Baker's earlier discovery of the true cause of the Devonshire Colic, it is obvious to remark that its indirect results, as working through the population of one county, and its direct results as bearing on those sailors to whom Huxham and others recommended the cyder of Devonshire as a preventive and cure of scurvy, must have been very small indeed when compared with those great sanitary labours and discoveries which have immortalized the names of Cook, Howard, and Jenner.

When I tried in my earlier lectures to do justice to the sanitary reforms of the 18th century, and especially to the labours of those whose names I have just mentioned, I omitted to notice as they deserve the striking facts bearing on the use of cheap extempore and temporary hospitals, for which we are indebted to that intelligent army physician, Dr. Brocklesby. If I ask leave of you to repair that omission now, it is partly because the subject of the erection of such hospitals is one of special and growing interest at this time, not to soldiers only but to the whole civil population. This is a condensed account of Dr. Brocklesby's experiences.

In the year 1758, we made an unprosperous attack on the coast of France, and brought home a great many sick soldiers, who were lodged in old houses, barns, &c., round Newport, in the Isle of Wight. In one of these close hovels, a poor soldier of the 63rd Regiment, just landed from a transport, was placed. He was soon seized with malignant sore-throat, which carried him off

on the third day. Another soldier, who was placed in the same bed (the sheets only being changed) was speedily attacked in the same way, and soon died. A third man was put into the same bed and shared the same fate. "Fresh bedding of every sort" was now ordered, and "the boards all around" were scraped and thoroughly washed with vinegar, and then a fourth soldier was lodged in this hovel and died. A second time this "ill-fated spot underwent a most rational purification" with abundance of vinegar fumes, burnt gunpowder, and burnt resins, and all the contiguous parts were scraped, washed, and fumigated. But, in spite of all this precaution, a fifth man was attacked and had a narrow escape of his life. Having thus lost four brave men, and "with difficulty saved the fifth," Dr. Brocklesby would not suffer another soldier to be lodged in this place till after seven or eight days; but a sixth soldier, having then been placed there, he too caught the disease, and had a narrow escape. Taught by this sad experience, and finding that the soldiers landed from the transports were more numerous than could be accommodated in all the spare out-houses, barns, and empty cottages which money could procure, or humanity supply, it was resolved to erect a temporary shed with deal boards, upon the open forest, to thatch it with a coat of new straw, thick enough to keep out wind and rain, and to make it large enough for 120 patients. A country workman did the work (charging for the use of the boards) for 40*l.* Here I quote Dr. Brocklesby's words:—"Although the hovel was finished in a fashion the most slovenly, and apparently inadequate to the end proposed, upon trial it was found, that notwithstanding much extraordinary cold as well as moisture which the sick there lodged had suffered, remarkably fewer died of the same diseases, though treated with the same medicines and the same general regimen, than died anywhere

else ; and all the convalescents recovered much sooner than they did in any of the warmer and closer huts and barns hired round Newport, where fires and apparently better accommodation of every sort could be provided for them."

Now this striking fact happened to come to the knowledge of Mr. Adair, Inspector of Regimental Infirmaries, who was in the neighbourhood, and he, "remarking that this currency of fresh air had such amazing salutary effects upon the men hutted in the forest, procured an order to convert Carisbrooke Castle itself, situated upon the extremity of a very high ridge of land, into one large general hospital, where near 400 sick might, on occasion, be lodged together."

"At first," says Dr. Brocklesby, "it was expected that the sick brought to that place would do better than their comrades who were lodged up and down in the miserable huts of the town, or than those upon the wild bare forest near Newport, under that occasional hovel" (meaning the 40*l.* extempore hospital). "Yet the event verified our conjectures only in part, for though the castle was more prosperous to their recovery than the small rooms in low-roofed houses, yet more, proportionally, of the foresters were recovered, and that much sooner than any of the rest ; and it evidently appeared that all the damage and inconvenience the men suffered from cold or redundant moisture in that place, was much fitter to be tolerated on the whole than the mischiefs complicated on the sick by huddling together 300 or 400 men and upwards, under one roof, and in the outhouses adjoining to the castle."

But Dr. Brocklesby has still something to tell us about cheap extemporized hospitals and their good effects ; for two years later (1760) a dangerous putrid fever made its appearance amongst the sick of the 30th Regiment, at

Guildford, in Surrey, which led him to erect other hospitals, with like good results, and at the reduced cost of something above 10*l.* a-piece.

The sick soldiers were at first taken to their infirmary about five miles from the camp. As this place was crowded with more than four times the number it ought to have contained, Dr. Brocklesby remonstrated, and obtained from General Cornwallis plenary powers to act. It was "in the beginning of September, 1760, when very unusual numbers from the 30th Regiment," and a few from other regiments, "were daily falling sick of putrid petechial fevers, and when proper accommodations for the sick could by no means be procured in the town of Guildford, that the doctor made his second experiment.

He "pitched upon the dryest and most airy spot," on a rising ground in a field behind the camp; hollowed out as much of the dry sandy soil as he required, and near the edge of the hollowed ground drove in upright stakes, about six feet high from the surface, and placed wattles between them, coated on the side next the weather with fresh straw. Rafters were laid over in a workman-like manner, and coated thick like the sides. This made the hollow "spacious and airy over head, and yet abundantly warm and dry."

This structure cost the public ten guineas, added to 5*l.* for straw, and gratuities to the bricklayers, who built a large chimney and set a kitchen-grate. So that probably this hospital, for forty patients, did not cost more, from first to last, than 20*l.* Now Dr. Brocklesby tells us "that though several soldiers were admitted into this 'repository,' ill of a true petechial jail-fever, only one or two, at most, died in it;" and he adds, "I candidly ascribe their fortunate escape more to the benefit of a pure, keen air they breathed therein every moment than to all the medicines they took every six hours or oftener. For on

account of the nature of this sandy soil, there was an opportunity to remove, as oft as necessary, the whole inner surface of the floors and walls, which might be suspected to imbibe and retain any infectious matter proceeding from the patients; and the sand so scraped off was, every three or four days, ordered to be thrown out of doors."

Dr. Brocklesby had still another and another opportunity of trying this happy expedient of cheap extemporized hospitals, in 1761 and 1762. In the first of these years there was a militia camp at Winchester, and much sickness there. The soil was chalk; and he proceeded to dig three pits, thirty-one feet long, nineteen wide, and five deep; at a foot from the edge of these pits he drove stakes, six feet apart, formed his walls with wattles and thatch, and his roof of the same materials. A brick chimney, and boards fastened along the line of the men's heads, completed these "mansions for the sick." Air-holes in the thatch, to be occasionally opened, served as windows and ventilating apertures; and steps, cut in the chalk, gave access to the interior. To these three mansions the fever cases from the "close infirmary at Winchester, as well as from the camp," were admitted; and, in less than a fortnight, the numbers were reduced in the proportion of four to one, the number of sick to the end of the campaign were much fewer than ever before, and all the men admitted, "except three at most," were cured. The following year, 1762, the same plan was adopted on the chalky soil of a different encampment, a large, airy porch being added before each door. A regiment encamped there lost not a man during the whole encampment; while "Some other regiments of the brigade, who had invincible prejudices against the above practice, lost several of their sick in that and the previous year. And all that time," says the worthy

doctor, "the militia themselves were known to give ten guineas, or more, for a good recruit to supply the place of the deceased."

This abstract of Dr. Brocklesby's experiences with cheap extemporized hospitals I have laid before you as both instructive and suggestive—as equally applicable to war and peace, and as bearing directly on one of the most important hygienic questions of the day. His facts are in perfect harmony with Sir George Baker's interesting narrative of the outbreak of small-pox at Blandford, when patients in natural small-pox fared better under hedges and dry arches than those who had been inoculated did in their own dwellings.*

In treating of the conscious and sustained efforts of the 18th century, in the direction of sanitary improvement, and especially of these experiences of Dr. Brocklesby, I have almost insensibly encroached on the second topic to which I proposed to address myself. I mean the discoveries and inventions directly applicable to the wounded and the sick. With a view of giving completeness to this branch of my subject, I have made some attempts to ascertain the order and dates of those surgical inventions, such as the tourniquet and the trephine, which are specially applicable to injuries received on the field of battle, or during naval engagements. But I was obliged to content myself with the scanty information that inventions of this order are of very ancient date, though some improvements, such as Petit's substitution of the screw for the stick in the tourniquet, may be traced to those who first proposed them. Nor do we know how that "fear of hæmorrhage," which, as Samuel Cooper expresses it, "retarded the improvement of our profession for ages," was gradually overcome; or who it

* See "Public Health," Part I., Lecture I., p. 16.

was that first dared to amputate a limb, without waiting till mortification had set in; or when and by whom the knife was first used to supersede the burning irons and tight ligatures of the older surgery. Even that capital improvement, the use of the ligature to bleeding vessels, which Ambroise Paré introduced into practice, he himself traces back, as a suggestion, to Celsus and Galen; as an invention, to the inspiration of the gods.

But whatever the uncertainty that hangs over the authorship and date of the more important surgical instruments and methods of treatment, it does not admit of doubt that the middle of the 16th century (say from 1536 to 1569, when Ambroise Paré served with the armies of France, or some years later, when Thomas Gale and John Woodall were gaining experience of military surgery here, in England), was a very important epoch for all fighting men. The ligature, which the older writers had recommended, and Paré's predecessor, as a great surgical authority, John de Vigo, had distinctly described, Paré used systematically and constantly. But he earned another title to the affectionate regard of all men suffering from gunshot wounds. For he was the first to discover the fallacy, so fruitful of suffering, which had condemned men so wounded to the torture of boiling oil. As this discovery of Ambroise Paré, and the important reform to which it led, is both instructive in itself and typical of the many improvements in the practice of our art that have consisted in abstinence from some mischievous interference dictated by science falsely so called, I shall make no apology for detaining you while I give a brief account of it. It is Paré's own history, done into English by one Thomas Johnson, who published a translation of his collected works, with many misgivings and apologies, in 1634.

When Ambroise Paré, then about thirty years of age,

had his first experience of war, one John de Vigo, surgeon to Pope Julius II., seems to have been as much an oracle in surgery as the Pope himself was in religion. Now this John de Vigo, in his work published early in the 16th century (our College Edition of it is dated 1514), in treating of wounds, classes those made by gunshot with bites of serpents and other like injuries, as being poisoned; and prescribes for the whole class a treatment by boiling oil.

Now it happened that Paré, in the year 1536, was serving with a French army in Italy, that had just fought a battle, in which there were many wounded on both sides, with all sorts of weapons, but chiefly with bullets; and our surgeon honestly confesses that at that time he was not very expert in matters of chirurgery, nor used to dress wounds made by gunshot. But he had read in John de Vigo, that wounds made by gunshot were venenate or poisoned, and *that* by reason of the gunpowder; wherefore for their cure it was expedient to burn or cauterise them with oil of elders scalding hot, and a little treacle mixed therewith. But Paré was a sceptic, and gave no credit to the author or his remedy; for he knew that caustics could not be poured into wounds without excessive pain. Still he would run no risk; and determined to ascertain whether the chirurgeons who were with him in the army used any other manner of dressing to these wounds. But he saw that they all used that method of dressing which Vigo prescribed, and filled as full as they could the wounds made by gunshot, with tents and pledgets dipped in this scalding oil at the first dressing. This encouraged Paré to do the like to those who came to be dressed of him. But it chanced on a time, that by reason of the multitude that were hurt, he wanted this oil; and because there were some few left to be dressed, he was forced, that

he might seem to want nothing, and that he might not leave them undressed, to apply a digestive made of the yelk of an egg, oil of roses, and turpentine. But Paré could not sleep all that night. His mind was ill at ease ; the dressing of the precedent day, which he judged unfit, troubled his thoughts ; and he feared that the next day he should find them dead, or at the point of death by the poison of the wounds, whom he had not dressed with the scalding oil. Therefore, he rose early in the morning to visit his patients, and found beyond expectation such as he had dressed with a digestive only, free from vehemency of pain, to have had good rest, and that their wounds were not inflamed or tumefied ; but, on the contrary, the others that were burnt with the scalding oil were feverish, tormented with much pain, and the parts about their wounds were swollen. When he had many times tried this better treatment in divers others, Paré thought thus much, that neither he nor any other, should ever cauterise any wounded with gunshot.

But the history of this most interesting discovery and reform in surgical treatment is not yet complete. It connects itself with a secret remedy very famous in those days. I mean the *oleum catellorum*, or oil of whelps, of which this is a true account. "When," says Ambroise Paré, "we first came to Turin, there was a chirurgeon far more famous than all the rest in artificially and happily curing wounds made by gunshot ; wherefore I laboured with all diligence for two years' time, to gain his favour and love, so that at length I might learn of him what kind of medicine that was which he honoured with the glorious title of balsam, which was so highly esteemed by him, and so happy and successful to his patients ; yet could I not obtain it. It fell out a small while after, that the Marshal of Montejan, the King's Lieutenant-general then in Piedmont, died ; where-

fore I went unto my chirurgeon, and told him that I could take no pleasure in living there, the favourer and Mecænas of my studies being taken away; and that I intended forthwith to return to Paris, and that it would neither hinder nor discredit him to teach his remedy to me, who should be so remote from him. When he heard this he made no delay, but presently wished me to provide two whelps, one pound of earth-worms, two pounds of oil of lilies, six ounces of Venice turpentine, and one ounce of aqua vitæ. In my presence he boiled the whelps, put alive into that oil, until the flesh came from the bones; then presently he put in the worms, which he had first killed in white wine, that they might be so cleansed from the earthy dross with which they are usually replete; and then he boiled them in the same oil so long till they became dry, and had spent all their juice therein; then he strained it through a towel without much pressing; and added the turpentine to it, and lastly, aqua vitæ; calling God to witness that he had no other balsam wherewith to cure wounds made with gunshot, and bring them to suppuration. Thus he sent me away, as rewarded with a most precious gift, requesting me to keep it as a great secret, and not to reveal it to any.

If I had time, I should like to make this singular history the text for many an instructive comment; but I cannot refrain from pointing out the curious psychological phenomenon presented by the great French surgeon. His mind was too acute not to suspect the mistake his contemporaries made in following De Vigo's precepts, and adding the tortures of scalding to the pain of gunshot wounds; and yet something or other in his mental composition and habits of thought withheld him from recognising in this oily slime the negative virtue of his own extempore compound of yelk of egg, oil of roses, and turpentine. Perhaps it was the two long years spent in

gaining the favour and love of the inventor; perhaps the superstitious belief, from which even a Paré could not free himself, that the principle of life might be transferred in some mysterious manner from the poor whelps and earth-worms to the fluids in which their lives were extinguished.

Next in order of time, and greater in practical importance, among the discoveries which have tended to ameliorate the lot of fighting men, the military historian would have to note the good service rendered by John Woodall, the author of the "Surgeon's Mate."

This able and experienced master of chirurgery, in a treatise on the scurvy, which, if we set aside the first words of his definition, to wit, that it is a "disease of the spleen," would scarcely discredit an author of our own day, sets forth the juice of lemons, limes, oranges, and tamarinds, but especially the juice of the lemon, as the true remedy for the disease. Nor was this merely a speculative opinion of his; for he tells us that at the time at which he wrote (1617) there was "a good quantity of juice of lemons sent in each ship out of England by the great care of the merchants." He commends it as "a precious medicine and well tried," prescribes two or three spoonfuls of it every morning fasting, with a little at night, and as an addition to each purge; and he heartily approves the use some surgeons made of it as a preservative. This real remedy, preventive and curative, seems to have fallen into disuse in later times; and it was not till about two centuries later (in 1796) that it was ordered to be regularly served out to the crews of our ships of war.

Lemon-juice was the first of those remedies, of which we have so few, that are not only curative, but also preventive, and which (unlike mercury, arsenic, antimony, opium, and the lancet) scarcely admit of being used in

excess or misapplied. The second remedy of the same class, brought into use in this same seventeenth century, but about fifty years later, is of special interest to our soldiers and sailors; I mean cinchona bark and its alkaloid, quinine. Need I remind you that, in this century also, and about the same time that we first made acquaintance with the Jesuits' bark, coffee, chocolate, and tea gradually came into use; or that the potato, the boon of the previous century, the most portable and storeable of our antiscorbutic vegetables, and tobacco, the solace of all fighting men, another boon of that century, were coming into general use among all classes of the population. Our fighting men were also greatly interested in that great reform in treatment due to John Crane, of Cambridge, practising there about the middle of the sixteenth century, but which Sydenham revived and succeeded in establishing, I mean the "*cool regimen*."

These were the good gifts of the seventeenth century to our soldiers and sailors, as well as to the people at large. To the eighteenth century we owe the boon of *inoculation* (an unmixed blessing to the soldier and sailor, though open to obvious objection when applied to society at large); important experiments and inventions bearing on the *ventilation* of ships, prisons, barracks, and hospitals; Sir George Baker's fruitful discovery of the cause of colic; Captain Cook's demonstrations of the possibility of preserving the health of sailors in long voyages; Howard's grand prison reforms; and Jenner's gift of vaccination.

In addition to these more comprehensive sanitary improvements, which affected alike our civil population and our fighting men, there were special reforms that were brought to bear during this eighteenth century on the navy and army. Those that addressed themselves to the health of the navy are mentioned in some detail by Sir

Gilbert Blane. It was in 1761 that that great structural improvement, copper-sheathing, was introduced; in 1781 that small tenders and receiving ships were superseded by those better vessels known as *slop-ships*, from which recruits and pressed men were passed into the service in a cleanly and healthy condition; and still later in the century that much needed improvements were made in "the situation, fitting, and furniture of the *sick-berth*." It was not till the fourth year of the war (1796) that lemon-juice was fully introduced into the navy, and the naval surgeon was no longer required to furnish medicines at his own cost. It was probably in this year, too, that the better regulations respecting syphilis, alluded to in my tenth lecture, were brought into play.

Sir Gilbert Blane also alludes to measures for cleansing and drying ships; to personal inspections at stated periods, to ensure cleanliness; to the separation of the sick from the sound; to measures for maintaining the purity of the water; the substitution of wine and tea for spirits; and the use of preserved meats, as wholesome appliances brought into use towards the end of the eighteenth century. I have elsewhere shown how effectual were these measures, supplementing the more comprehensive and far-reaching sanitary discoveries and reforms already referred to, in improving the health and increasing the efficiency of the navy. I reproduce some of the figures I have already quoted.* They show the number of sick in five years of the war in which the seamen and marines voted by Parliament were 120,000. The sick were 20,544 in 1797, 15,713 in 1798, 14,608 in 1799; then after the lapse of six years, 8083 in 1805, and 7662 in 1806. The two years of the war in which

* See "Public Health," Part I., Lecture I., p. 24, and Lecture VI., p. 163.

the parliamentary vote was for 100,000 seamen and marines, gave similar results—in 1795, 22,909 sick, in 1804, 7650—less than one-third.

All the great sanitary reforms and inventions of the eighteenth century doubtless had their effect, both indirect and direct, upon the army; but I believe that I am justified in stating that no considerable or well-defined sanitary improvements and reforms were introduced into the military service during the war that ended in 1815. They belong to a later period, and may be reserved for some future opportunity. In saying this I am not unmindful of the services rendered by Robert Jackson to the army by the works which he published within a few years of the outbreak of the war—works which abound in valuable suggestions based on his own experience, especially in warm climates, and supported by many a learned reference to earlier writers. But taking all things into account, it is obvious that we entered on our great contest with France, and the nations which she first conquered and then arrayed against us, with advantages such as we had enjoyed in no previous war; and we were still to profit, at least during the latter part of the struggle, by the substitution of vaccination for inoculation. And had we been quite true to ourselves, had the Government from the very first availed itself of all the knowledge that had been placed at its disposal; if fever could no longer be imported from our jails, or small-pox from our naval hospitals; had the lessons taught us by Howard, Sir George Baker, Brocklesby, Jackson, and many others, respecting overcrowding and its manifold mischiefs, been duly appreciated and acted on; had lemon-juice been supplied to our navy from the first; had bark been largely administered as a preventive whenever, as at Walcheren and in the Peninsula, ague and remittent fever showed themselves; had intemperance

been discouraged to the utmost—in a word, if Government had but known and felt all that health is to armies and fleets, all that disease can do to defeat the best plans of the most skilful commanders, it is hard to say what thousands of men and millions of money might not have been saved, what failures averted, what grand successes achieved. But we wasted our strength over and over again in the early years of the war, in ill-advised co-operations with French emigrés, as at Toulon and Quiberon, got entangled with Austria in the meshes of her obstructive Aulic Council, threw men and money with lavish hand into the greedy swamps of Holland, and when we had found out that the right road to France lay through Portugal and Spain, and knew that Wellington was the man who could lead us through it, we withheld the needful supplies of men and material, emulating in this respect the strange example of the haughty, jealous, and perverse Spaniard, who seems to have found it more easy to forgive the treacherous and cruel foe for robbing and oppressing him, than the generous friend for lavishing blood and treasure in his defence.

But I must not detain you much longer—only long enough to express a hope that I have not wholly failed in my treatment of that episode in the sanitary history of England which consists in the war with revolutionary and imperial France. I shall not have failed if I have left upon your minds the impression which is so strong upon my own, that of all the losses inflicted by war the greatest and the worst are those which the soldier and sailor share with the civilian, in the shape of health and life needlessly sacrificed by neglect of sanitary precautions; that to have a healthy army and navy they must be recruited from a healthy home population, and be followed by land and sea with a care and solicitude equal at least to that which we bestow on our civil population.

A nation of only thirty-two millions, with a vast manufacturing industry, a most busy and flourishing commerce, an Indian Empire to govern and retain, colonies to attract the most vigorous and enterprizing of our people, great fortresses to man and defend, cannot afford to waste the lives of its citizens, much less of those whom it has first selected to fight its battles and then submitted to a costly course of training, for the perilous work they have to do.

Throughout the long war with France one thing alone never failed us—the indomitable courage of our fighting men. Fifty-eight years of subsequent experience has done nothing to lessen our confidence in them. The men who scaled the heights of the Alma, held the ridge of Inkermann, and charged into the valley of Balaclava, were made of the same stout stuff as those who, nearly half a century before, hurled the veterans of France from the hill of Albuera, fought and won the battle of Corunna, drove the French out of Egypt, did not disgrace themselves even at New Orleans, and gave peace to Europe at Waterloo.

But alas! the perverse folly that planned the Walcheren expedition, and the mismanagement that tortured Wellington in Portugal and Spain, proved itself perennial in the Crimea. And we who look back to these events, and forward to possible wars (maybe with the Power that has just humbled France), are forced to ask ourselves these questions :—Will the soldier prove as true to his traditional courage as the State to its precedent of bad management and ill-placed economy? Will our sailors, amid the inevitable revolution in naval warfare, assert their old superiority? I think that I see a sufficient answer to these questions in the *Birkenhead* sinking into the sea with her noble crew of disciplined soldiers mustered on deck as if on parade; and in the examples,

more numerous than I can mention, of manly and chivalrous self-sacrifice, when commander and crew alike, having rescued women and children, think for the first time of their own safety. Burgoyne, on board the *Captain*, Knowles, on the deck of the *Northfleet*, prove that heroic courage and calm self-possession in men standing in full consciousness of all that it means to be on the very brink of destruction, are still the attributes of the English fighting man.

One consideration there is that must make us all hopeful of the future of England. The sea is for us a perennial source of courage and hardihood, of enterprise and adroitness; the highway to all lands; the element on which war may be waged with least loss of life; so that, England, with her comparatively small population, need not fear defeat from lack of seamen. May we not hope too, that the example of our successful campaign in Abyssinia will have taught us the precious lesson that England's true policy in all future wars is to seek a firm base of operations on the coast, whence to advance with all the aids of sanitary science and constructive skill to the most vital point of land attack? If ever again we seek hostile armies in the heart of broad continents, tempt defeat in swamps, or consent to fight side by side with the most promising of allies, we must have forgotten or ignored all that these lectures have taught about the great war with revolutionary France. We shall have deserved to fail as at Toulon, in Holland, at Walcheren, at New Orleans; and we shall need something more than the skill of a Wellington to repeat the successes of the Peninsula.

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THE END.

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A

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BEING A

HISTORY OF THE PREVALENT AND FATAL DISEASES OF THE ENGLISH POPULATION FROM THE EARLIEST TIMES TO THE CLOSE OF THE WAR OF THE FRENCH REVOLUTION IN 1815.

BY

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